ESL-TR-89-39
VOL III - PART 2

FULL-SCALE INCINERATION SYSTEM DEMONSTRATION VERIFICATION TEST BURNS AT THE NAVAL BATTALION CONSTRUCTION CENTER, GULFPORT, MISSISSIPPI - VOL III: TREATABILITY TESTS PART 2

D. J. HALEY, R. W. THOMAS, D. B. DERRINGTON, JR.

EG&G IDAHO, INC.
P. O. BOX 1625
IDAHO FALLS ID 83415

JULY 1991

FINAL REPORT

SEPTEMBER 1986 - FEBRUARY 1989

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

AIR FORCE ENGINEERING & SERVICES CENTER
ENGINEERING & SERVICES LABORATORY
TYNDALL AIR FORCE BASE, FLORIDA 32403

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This technical report is divided into eight volumes. This portion of the report comprises Volume II, which is further subdivided into 5 parts, including the appendixes. This volume describes the verification test burns conducted on a 100 ton/day mobile incinerator that was used to process soil contamination with the constituents of Herbicide Orange, namely 2,4,5-T, 2,4-D, and trace quantities of dioxin. The demonstration was conducted at the Naval Construction Battalion Center in Gulfport, Mississippi. This volume provides specific details concerning the planning efforts and data results from the test burns. Project managers and field engineers responsible for planning and implementation of hazardous waste remedial actions should find the information contained herein very useful.

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22a. NAME OF RESPONSIBLE INDIVIDUAL: MICHAEL L. SHELLEY, Major, USAF	22b. TELEPHONE (Include Area Code): (904) 283-60[illegible] / 22c. OFFICE SYMBOL: RDV

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PREFACE

This report was prepared by EG&G Idaho, Inc., P. O. Box 1625, Idaho Falls, ID 83415, under Job Order Number (JON) 2103 9027, for the Air Force Engineering and Services Center, Engineering and Services Laboratory, Tyndall Air Force Base, Florida 32403-6001.

This report summarizes work done between September 1986 and December 1986. Major Terry Stoddart and Major Michael L. Shelley were the AFESC/RDVS Project Officers.

The information contained in this volume describes the events, the planning efforts, and the data results of a test burn conducted on a 100 ton/day mobile incinerator that was used to process soil contaminated with constituents of herbicide orange. This volume is subdivided into five parts; Part 1 contains the final report on the verification test burns, Parts 2 through 5 contain the appendixes. Volumes I and III through VIII describe the incinerator operations, the soil excavation activities, and the additional testing required by the Environmental Protection Agency.

This report has been reviewed by the Public Affairs Office (PA) and is releasable to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

MICHAEL L SHELLEY, Maj, USAF, BSC
Chief, Environmental Actions R&D

FRANK P. GALLAGHER III, Col, USAF
Director, Engineering and Services Laboratory

NEIL J. LAMB, Lt Col, USAF, BSC
Chief, Environics Division

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LIST OF APPENDIXES

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APPENDIX A

TECHNOLOGY ASSESSMENT AND SELECTION FOR AIR FORCE FULL-SCALE DEMONSTRATION PROGRAM

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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3. PROCESS VALIDATION

3.1 Technology Assessment and Selection

The primary alternatives considered for the disposal or detoxification of dioxin-contaminated soils are presented below.

Soil contamination by polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) compounds, which are acutely toxic and have aroused great public concern, is a large environmental problem. In the state of Missouri, for example, about 40 sites have been contaminated with 2,3,7,8-TCDD. Through examinations of emergency measures and remedial options, terminal disposal methods have been conducted for the Missouri sites. Contamination at Johnston Island and NCBC is similar in TCDD concentration (generally 1 to 200 ppb) to Missouri, where concentrations range from 1 to 1600 ppb. At Johnston island and NCBC, however, 2,4,-D and 2,4,5-T ester residues are also present and must be considered in any potential treatment processes.

The following major approaches to managing soil containing TCDD or PCDD exist:

1. Excavation and offsite disposal or treatment

2. Excavation and onsite storage and treatment.

The costs incurred by excavation, transportation, and disposal or treatment at EPA-permitted hazardous waste facilities presently eliminate option 1 as a near-term environmental restoration technology.

Onsite treatment of TCDD in soil has great social and political appeal. Furthermore, restoration costs are reduced if excavation and transportation of the soil are eliminated.

Alternatives are classified as thermal, chemical, and physical; the availability of laboratory, pilot scale, or demonstration scale data relates to either dioxin or similar organic compounds.

3.1.1 Chemical Treatment

3.1.1.1 UV Photolysis. The International Technology Corporation (ITC) has developed a process of thermal desorption of dioxin from contaminated soil followed by destruction of that dioxin using ultraviolet light. This technology is potentially a flexible and viable alternative of dioxin detoxification. A pilot-scale demonstration of this process was conducted at NCBC in 1985. Results of the demonstration are being compiled in a final report by EG&G Idaho. Small-scale test runs will be conducted at a former HO storage site on Johnston Island in the central Pacific in early 1986.

3.1.12 Alkalide Polyglycoxide Process. Several companies have filed patents for processes that involve nucleophilic displacement of chlorine from dioxin in solution, on surfaces, and in soil by treatment with a combination of alkali or basic carbonate, an oxidizing agent, and an organic reagent, such as polyethylene glycol. Although most of the suggested procedures operate at elevated temperature, the Sea Macroni, Inc. patent states that the process is applicable at room temperature. Field testing at Times Beach, Missouri, is under way for a process marketed by Galston Associates. Advantages to the alkalide polyglycoxide process are its application as a continuous process, its high rate of reaction, and the generation of a completely decontaminated effluent stream. Disadvantages include uncertainty about the effect of water on the reaction and the need for laboratory testing to indicate effectiveness and optimize application for each case. This technology is applicable to in situ treatment of contaminated soils, although formulations and methods of application to the particular soil must be correctly defined and are not available at this time.

3.1.1.3 Chemical Oxidation with Catalyst. The successful degradation of dioxin dissolved in water, chloroform, nitromethane, carbon tetrachloride, or other organic solvents of non-nucleophilic character has been demonstrated. The procedure is based on oxidation catalyzed by small amounts of ruthenium tetroxide. At room temperature, TCDD in chloroform solution showed a half-life of less than 15 min. Disadvantages of this technology are the limited data base, expensive alloys needed for construction of materials, and toxicity of ruthenium tetroxide. The procedure is not expected to be applicable for in situ treatment of contaminated soils. It may be able to destroy small amounts of TCDD after its separation from soil and collection in an organic solvent.

3.1.1.4 Wet Oxidation.

3.1.1.4.1 Catalyzed Wet Oxidation--ITC has performed laboratory tests demonstrating greater than 99.5% reduction of TCDD in aqueous organic waste streams by the process of catalyzed wet oxidation. This process, carried out at temperatures between 175 and 225°C, is based on the use of catalytic amounts of multivalent transition metal ions, bromide, and nitrate ions to promote oxidation of organic compounds to CO_2, H_2O, and inorganic reaction products. The process involves high capital expense, is carried out at high pressures, and uses new technology. Application to contaminated soil would complicate the process, and because of the developmental state and projected high treatment costs, this technology will not be considered further.

3.1.1.4.2 Supercritical Fluids--The Modar Corporation has constructed a pilot plant to test a process based on the oxidation of dioxin in aqueous streams. Testing is to take place at Love Canal in the near future. The reaction takes place at supercritical water conditions (325°C, 5000 to 8000 psi), using air or oxygen as the oxidizing agent. Although the reaction is reputed to have very high reaction rates, the lack of a strong data base, in combination with the requirement for expensive corrosion-resistant materials of construction, limits the immediate applicability of this technology.

3.1.1.4.3 Organo-Metals Dechlorination Process--Numerous companies have developed similar methods to threat transformer oils contaminated with 100- to 1000-ppm PCBs. The methods are based on the dechlorination of PCBs using elemental metal (such as sodium) and a reagent (naphthalene in tetrahydrofuran in the Goodyear method). The methods yield a reusable transformer fluid or a usable fuel. Demonstration tests using Sun Ohio mobile units resulted in final PCB concentrations of 1 to 7 ppm. Goodyear estimates the cost of decontamination at 30 cents/gal of oil. This dechlorination method may be technically applicable to dioxin-contaminated organic liquids; however, soil containing moisture will result in high chemical costs.

3.1.1.4.4 Hydrazine Reduction Process--The Research Manufacturing Consultation (RMC) Corporation has tested a soil detoxification method using hydrazine (H_2H_4) and a catalyst in alkaline solution to reduce dioxin to harmless end-products. The process is reported to be suitable for in situ use or treatment of excavated material. In moist soil, the reaction produces hydrogen peroxide, which can oxidize other reaction products, such as benzene and phenol, to carbon dioxide and water. Excess hydrazine oxidizes to elemental nitrogen. Laboratory test results indicated that soil treated with ppm levels of dioxin were successfully detoxified, and RMC plans to conduct tests at Times Beach to gather data to establish the technical performance of the methods. Low capital and operating costs are projected for this treatment alternative.

3.1.2 Microbiological Treatment

3.1.2.1 Preliminary Microbial Metabolization. A few species of bacteria have been shown to have the ability to hydroxylate TCDD. Although this technology is very promising, it is currently limited by:

- The lack of data base

- Uncertainty regarding degradation intermediates and end-products, and their toxicity

- Complications that arise in soil detoxification applications because of the strong sorptive properties of TCDD on soil and consequent long-term uncertainties.

3.1.2.2 Preliminary Enzyme Applications. Although few companies are marketing processes to detoxify dioxin and PCBs through organic compound modification by enzymes, this emerging technology is limited by the same factors that limit microbial applications.

3.1.3 Thermal

3.1.3.1 Incineration. Laboratory studies have shown that destruction of 2,3,7,8-TCDD at temperatures above 800°C can be greater than 99% successful. Herbicide Orange contaminated with 2,3,7,8-TCDD was successfully incinerated at sea in the 1970s. Furthermore, rotary kiln incineration is a proven technology for a variety of other incineration needs.

A rotary kiln incinerator was chosen as the best available technology to demonstrate reliability and maintainability to achieve the stated goal at the lowest cost. The rotary kiln was chosen because of the availability of rotary kiln incineration data, the mobility of the proposed incinerator, and the lack of detailed data from the other processes considered. Although other alternatives could be made portable, the proposed incinerator is already portable and manufactured with existing readily available components.

3.1.3.2 Microwave Plasma Detoxification. The decomposition of PCBs in liquids or gases by exposure to the microwave-excited electrons of a gaseous plasma was investigated in pilot-scale tests by the USEPA Solid and Hazardous Waste Research Division. Conversion efficiency of only 99% was achieved; however, tests on highly chlorinated pesticides resulted in

conversion efficiencies of 99%. Decomposition products from microwave plasma tests on Aroclor 1242 (PCB) liquid were identified as CO_2, CO H_2, $COCl_2$, Cl_2CO, and HCl. Although this technology may have application to detoxification of dioxin-contaminated material, the state of process development precludes its further consideration at this time.

3.1.3.3 Vitrification. A soil detoxification process proposed by Battelle Northwest decomposes organics and converts inorganics to glass. It is based on heating soil using electrodes placed at depths of up to 30 to 40 ft in the soil. High voltage is applied to the electrodes for 3 to 5 days. The area being treated is covered, and the off-gases generated are collected for treatment. Projected costs for treatment using this process are \$100 to \$400/yd^3 of soil. Costs are dependent on soil moisture, electrode spacing, and required depth of vitrification. The lack of a strong data base for this innovative technology and projected high costs preclude its further consideration for application to this case.

3.1.3.4 Plasma Arc Pyrolysis. A mobile pyrolytic unit centered around a plasma arc device and plasma reactor is to be tested by Pyrolysis Systems Incorporated at Love Canal for the destruction of TCDD in liquids and sludges. Tests conducted on a similarly designed pilot unit at the Royal Military College of Canada showed a destruction removal efficiency of 99.9999999% in the destruction of Askarel (PCB). In either unit, wastes are injected into a co-linear electrode space, where they are atomized by plasma species relaxing from highly activated states to lower levels. Wastes are then pyrolized in the reactor. Hydrogen chloride by-product from the pyrolysis reaction of chlorinated organic compounds is converted to sodium chloride in a caustic scrubber. The mobile unit is sized to accept 1 to 2 gal/min of waste material. Until pilot testing data are available, the regulatory acceptability and technical feasibility for application to contaminated soil are not clear.

3.1.3.5 Corona Glow Processing. Westinghouse Electric Corporation has developed a process to destroy organic materials in carrier gas streams by passing the gas stream through the discharge region of a corona glow

device. The discharge excites molecules, rupturing bonds and resulting in detoxification of the organic material. This innovative technology presently has a limited data base and is not directly applicable for contaminated soils.

3.1.3.6 Radio Frequency Detoxification. Several companies have proposed an in situ soil decontamination technique based on heating the soil using radio frequency waves. The technology is discussed in an EPA publication "Decontamination of Hazardous Waste Substances from Spills and Uncontrolled Waste Sites by Radio Frequency In Situ Heating," PB84-167642, 1984. Field demonstrations of this process have been conducted on oil shales and tar sands for the recovery of liquid hydrocarbon fuels. Although this process may be technically feasible, it is not a practical choice for demonstrating decontamination of soil because of projected high capital cost, high power cost, uncertainty that all the material can be decontaminated to the desired specification at the required soil depths, and the difficulty and unreliability of collecting all vaporized compounds for subsequent treatment/destruction.

3.1.4 Separation and Concentration Technologies

These technologies are intended to separate TCDD from other matrices, thereby decontaminating the matrix. The intent is to transfer the TCDD into a medium in which it can be treated more effectively using one of the technologies identified above, or to concentrate the TCDD into a small volume waste that can be stored, transported, and disposed of at an offsite commercial facility.

3.1.4.1 Extraction. ITC, in a report to the USEPA-CHMSB entitled "Laboratory Feasibility Testing of Prototype Soil Washing Concepts," presents results of laboratory testing of the extraction of 2,3,7,8-TCDD from soil using solvents, water, and water/surfactant solutions. Extractant systems tested were toluene/IPA, Freon, Freon/methanol, diesel fuel/water, kerosene/water, water, water/Adsee 799 (a surfactant), and water/Hyonic (a surfactant). After three simple batch extractions, the most effective

extractant, the Freon/methanol system, removed 97.1% of the TCDD from spiked soil samples. The water extractant system, after one extraction, removed less than 1% of the TCDD. The water/surfactant systems, after three extractions, removed 75% of the TCDD from spiked soil samples. The data in this report indicate that extraction using solvents, water, or water/surfactant systems is not a viable means of achieving the 99% removal of TCDD required for detoxification of soil contaminated in the 100- to 1000-ppb range. The quantities of solvent and number of extraction stages would be impractical due to the low extraction efficiencies, and 1-ppb levels were not achieved.

3.1.4.2 Adsorption. The very low solubility of dioxin in water makes it a good candidate for effective carbon adsorption. Similar compounds, such as PCB, can be effectively adsorbed onto carbon from solvents such as Freon. However, limited data are available regarding dioxin adsorption, and until a data base is developed, carbon adsorption of dioxin remains an unproven technology. Adsorption is only applicable to treating water or certain solvents contaminated with TCDD, accomplishing a separation/volume reduction function. Spent carbon would still require ultimate disposal or destruction.

3.1.4.3 Distillation/Stripping. Another separation/concentration technique that could be considered for contaminated liquids is distillation or stripping. For aqueous streams, removal of dioxin by steam stripping may be technically viable because it has a very high activity coefficient in water. For organic (solvent) solutions containing dioxin, distillation of the lower boiling organic from the high boiling dioxin should be technically feasible, but neither technology has been demonstrated on any scale for dioxin-containing liquids.

APPENDIX B

CORRESPONDENCE WITH EPA REGION IV ON RCRA RESEARCH, DEVELOPMENT, AND DEMONSTRATION (RD&D) PERMIT APPLICATION FOR FULL-SCALE DEMONSTRATION AT NCBC

The items contained in this appendix include various letters sent to EPA Region IV in an effort to secure an RD&D permit. They were reproduced from the best available copies. Due to poor original legibility, the legibility of the microfiche editions may also be poor. Persons requiring the information contained in this appendix may write to the technical libraries listed below to obtain photocopied versions of the appendix. A nominal charge will be levied to cover reproduction costs. Please be prepared to provide the following information:

Report Title:	Full-Scale Incineration System Demonstration Verification Test Burns at the Naval Construction Battalion Center, Gulfport, Mississippi: Treatability Tests
Report Number:	ELS-TR-88-61, Volume: II, Part: 2, Appendix: B
Send inquires to:	Technical Library Engineering and Services Laboratory Tyndall Air Force Base, FL 32403
or	Technical Library Idaho National Engineering Laboratory EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415-2300

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Appendix B, Exhibit 1

Idaho National Engineering Laboratory

bcc: J. N. Casanova
K. L. Falconer KF
D. J. Haley
T. H. Smith
D. L. Uhl
Central Files
H. D. Williams File
Hazardous Waste Progr

January 20, 1986

Mr. George Harlow
Deputy Director, Air/Waste Management Division
EPA, Region IV
345 Cortland Street NE
Atlanta, GA 30365

TRANSMITTAL OF RD&D APPLICATION FOR USAF RESEARCH AND TEST EVALUATION -HDW-02-86

Dear Mr. Harlow:

Based on the 1984 RCRA Amendments and proposed guidance for Research, Development, and Demonstration (RD&D) permits, EG&G Idaho, Inc. has prepared an application for RD&D permitting of the U.S. Air Force (USAF) Full Scale Demonstration project. The project is to be performed at the Naval Construction Battalion Center (NCBC), Gulfport, MS., and this application is therefore submitted to you at Region IV, EPA, Atlanta, GA.

Pursuant to discussions with Capt. T. L. Stoddart, USAF Engineering Services Center, and in consideration of coordination with other agencies, this document is also being transmitted to the Dioxin Disposal Advisory Group (DDAG), and the Mississippi State Department of Natural Resources. Enclosed are seven (7) copies, two (2) of which have copies of this letter attached for Mr. Art Linton and Mr Wayne Mathis. We would ask that you forward their copies to them.

Captain Stoddart has arranged for a presentation of this information to the Region IV in Atlanta, GA. on January 29, 1986 at 0900 hours. Representatives of EG&G Idaho, Inc. and its subcontractor, ENSCO Corporation, will be present to provide additional information or answer questions as they arise.

Appendix B, Exhibit 2

bcc: D. J. Haley
T. H. Smith
D. L. Uhl
H. D. Williams
Central Files
J. N. Casanova File
Hazardous Waste Projec

INEL
Idaho National Engineering Laboratory

May 9, 1986

Mr. James Scarbrough, Chief
Residuals Management Branch
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, NE
Atlanta, GA 30365

ATTN: Caron Falconer

REVISION AND RESUBMITTAL OF RD&D PERMIT APPLICATION TO REGION IV - JNC-19-86

Dear Mr. Scarbrough:

Enclosed is the revised RD&D permit application for the proposed USAF technology demonstration at Gulfport, Mississippi. The document has been revised to incorporate comments received through your offices. Revisions or changes to the document are as follows:

Executive Summary, Page 2	The criteria to be met in this project is identified as being presented in Appendix A of the application.
	The commitment to furnish Region IV with a copy of the final report has been inserted.
Page 1-1	The duration of the project and quantity of soil to be treated has been changed to 150 days and 11,000 yd^3.
	The goals and criteria for the demonstration have been added.
Page 2-6	Burners for the kiln are identified as natural gas burners.
Page 2-11	Prevention of fugitive emissions from the stack via negative pressure of the system has been clarified.
Page 2-24	Materials other than soil which will be fed to the incinerator are identified.
	Certification of equipment erection and disassembly by a registered professional engineer has been added.

Page 2-26 & 2-28	Footnotes have been added which clarify that a loss of combustion air supply will activate the automatic waste feed shutoff circuit, and that all stack gas monitoring will occur during the test burn.
Page 5-1	General training requirements have been added.
Page 5-18	A description of the scrubber water handling has been added.
Page 5-20	The soil handling has been revised to allow emplacement of the treated soil back on the HO site.
Page 6-1	Sampling and analysis protocol has been specified as SW846 and the dioxin rules.
Page 8-2	Waste handling has been clarified.
Page 8-3	Item 4 - Handling of liquid wastes via land application has been deleted and dischage to the POTW added.
Appendix A	The appendix has been modified to identify and explain the criteria which will be met for this demonstration.

A signed Certification Statement (Executive Summary, p. 4) as well as a Notification of Hazardous Waste Activity Form (Appendix F) with signature of owner and operator will be forwarded to your office within the next two weeks.

Thank you for your cooperation and assistance in helping us submit a complete application. If you have and questions or requests, please call me at FTS: 583-9736.

Very truly yours,

J. N. Casanova

J. N. Casanova, Program Specialist
Hazardous Waste Programs

lap

cc: J. Cluff, NCBC
J. Lanier, ENSCO
M. Rich, State of Mississippi
Capt. T. L. Stoddart, USAF
J. O. Zane, EG&G Idaho

Appendix B, Exhibit 3

INEL
Idaho National Engineering Laboratory

bcc: K. L. Falconer KLF
T. H. Smith
J. N. Casanova File
Hazardous Waste Projects

March 11, 1986

Mr. James Scarbrough, Chief
Residuals Management Branch
U.S. Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, GA 90365

TRANSMITTAL OF ENSCO TEST BURN PLAN -JNC-12-86

Dear Mr. Scarbrough:

Enclosed is a copy of ENSCO's revised test burn plan for your reivew of the test burn data submitted earlier.

If you have any questions, please call me on (208) 526-9736.

Very truly yours,

J N Casanova

J. N. Casanova
Senior Program Specialist
Hazardous Waste Projects

ag

Enclosure:
As Stated

EG&G Idaho Inc P.O. Box 1625 Idaho Falls, ID 83415

Appendix B, Exhibit 4

bcc: K. L. Falconer
T. H. Smith
D. L. Uhl
H. D. Williams
Central Files
J. N. Casanova File
Hazardous Waste Project

Idaho National Engineering Laboratory

February 25, 1986

Mr. James Scarbrough
Chief, Residuals Management Branch
U.S. Environmental Protection Agency
Region IV
345 Cortland Street NE
Atlanta, GA 30365

SUBMISSION OF ENSCO TRIAL BURN DATA -JNC-09-86

Dear Mr. Scarbrough:

The following are being submitted to you in support of the RD&D permit application process for the U.S. Air Force dioxin destruction technology demonstration planned to take place at the Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi.

1. Enclosure 1 is the trial burn data for Phase I (waste solvent trial burns) for the ENSCO modular incinerator. Also enclosed is a hand written summary of DRE's from the test burns.

2. Enclosure 2 is a copy of correspondence to the Office of Solid Waste to keep you informed of our efforts to obtain approval on the delisting petition.

We understand from conversations between Capt. Terry Stoddart, USAF, and your office, that comments on the original submittal of the RD&D permit application are forthcoming. In addition, the original submittal of the permit application will be revised to include the option for storage of the treated soil should we encounter major problems in the delisting petition process.

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

Appendix B, Exhibit 5

cc: U. J. Haley
T. H. Smith
D. L. Uhl
H. D. Williams
Central Files
J. M. Casanova File
Hazardous Waste Projec

Idaho National Engineering Laboratory

June 2, 1986

Mr. James Scarbrough, Chief
Residuals Management Branch
U.S. Environmental Protection Agency
Region IV
345 Courtland Street NE
Atlanta, GA 30365

REQUEST FOR CHANGES IN RD&D DRAFT PERMIT -JNC-20-86

Dear Mr. Scarbrough:

The following are changes we are requesting to the USAF RD&D draft permit, the location of the affected text in the draft permit and the RD&D permit application, and the associated reasons for the request.

Page 11 of draft permit, Part II, Section I, Item 3:

The permit application (page 5-19) specified neutralization of the scrubber waters to a pH of 6.5 to 7. We are requesting a range of pH 6 to 9. The acceptability of this pH is being verified with the local POTW.

Page 12 of draft permit, Part III, Section C:

We are requesting a change in the feed rate of this contaminated soil from 2-3 tons/hr to 0-5 tons/hr. This change is being requested such that the demonstration aspect of this project can be fulfilled, that is, to test the incinerator at different feed rates to determine the most effective and cost beneficial operating parameters.

Page 13 of draft permit, Part III, Section D:

Item 1 - We are requesting that the range for the kiln temperature be increased from 1600-1800°F to 1200-1800°F to help reduce slag formation.

If you have any questions or requests, please feel free to call me at FTS 583-9736.

Very truly yours,

J. N. Casanova
Senior Program Specialist
Hazardous Waste Projects

ag

Enclosures:
As Stated

cc: (w/o Enclosures)
I. Aoki, DOE-ID
Capt. T. L. Stoddart, USAF
J. O. Zane, EG&G Idaho

Item 2 - Because of the RD&D nature of the project, we are requesting that the temperature of the secondary combustion chamber be changed from 2200°F to a minimum of 2150°F.

Item 3 - Because of the changing operating parameters for testing, we are requesting change in the residence time from 2 seconds to a range of 1 to 2 seconds.

Items 5 and 6 - We are requesting that the recirculation flow rates to the packed tower and scrubber be maintained to meet scrubber efficiency requirements.

Item 9.d. - The residence time is alarmed but does not activate the automatic waste feed shutoff.

Should any of these requested changes cause major problems in the permitting process, please notify me, (208) 526-9736, and a conference call can be easily arranged.

Very truly yours,

J. N. Casanova
Senior Program Specialist
Hazardous Waste Projects

ag

cc: I. Aoki, DOE-ID
J. Lanier, ENSCO
Capt. T. L. Stoddart, USAF
J. O. Zane, EG&G Idaho

Appendix B, Exhibit 6

INEL
Idaho National Engineering Laboratory

bcc: K. L. Falconer
D. J. Haley
T. H. Smith
D. L. Uhl
H. D. Williams
J. N. Casanova File
Hazardous Waste Program

January 24, 1986

Mr. James Scarborough
Waste Engineering Section
Waste Management Division
Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, GA 90365

SUBMISSION OF NOTIFICATION OF HAZARDOUS WASTE ACTIVITY -JNC-02-86

Dear Mr. Scarborough:

Enclosed is the subject EPA Form 8700-12 (6-85). A generator identification number is sought in association with a proposed Research, Development, and Demonstration (RD&D) project for which a permit application has been submitted to your Region. The proposed RD&D project will be to conduct field demonstrations of a mobile incinerator to treat 2,3.7.8-tetrachlorodibenzo-p-dioxin contaminated soil at the Naval Construction Battalion Center in Gulfport, Mississippi. Wastes generated will be in association with this RD&D project.

The RD&D permit application has been submitted for the U.S. Air Force, Engineering and Services Center, by EG&G Idaho, Inc., to Mr. George Harlow, Deputy Director, Air and Waste Management Division, EPA-Region IV.

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

If you should have any questions, please feel free to contact me at (208) 526-9736, (FTS 583-9736).

Very truly yours,

J. N. Casanova
Senior Program Specialist
Hazardous Waste Programs

ag

Enclosure:
As Stated

cc: (w/o Enclosure)
I. Aoki, DOE-ID
Capt. T. L. Stoddart, USAF
J. O. Zane, EG&G Idaho

APPENDIX C

PUBLIC NOTIFICATIONS FOR RD&D PERMIT ON FULL-SCALE DEMONSTRATION AT NCBC

The items contained in this appendix include various newspaper articles that were published in the Gulfport, Mississippi area as part of EPA requirements and the Air Force commitment to public involvement. They were reproduced from the best available copies. Due to poor original legibility, the legibility of the microfiche edition is also poor. Persons requiring the information contained in this appendix may write to the technical libraries listed below to obtain photocopied versions of the appendix. A nominal charge will be levied to cover reproduction or archival costs. Please be prepared to provide the following information:

Report Title: Full-Scale Incineration System Demonstration Verification Test Burns at the Naval Construction Battalion Center, Gulfport, Mississippi: Treatability Tests

Report Number: ELS-TR-88-61, Volume: II, Part: 2, Appendix: C

Send inquires to: Technical Library
Engineering and Services Laboratory
Tyndall Air Force Base, FL 32403

or Technical Library
Idaho National Engineering Laboratory
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-2300

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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APPENDIX C

TABLE OF CONTENTS

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Appendix C, Exhibit 1

The following legal notice appeared in the Wednesday, March 19, 1986 edition of the Sun Herald. For the sake of legibility and reproducibility it has been transcribed below.

PUBLIC NOTIFICATION

Notice is hereby given of a public hearing to be held March 20, 1986 at the Westside Community Center, 4010 W. Beach Gulfport, Miss, beginning at 7 PM. Briefings presented will cover an Air Force research and development project to remove contaminants from the soil at a former herbicide orange storage site on the Naval Construction Battalion Center in Gulfport. Following presentation of material, Air Force and Navy personnel will open the floor for public questions and comments on the project, scheduled to begin in July 1986. For further information, contact the Naval Construction Battalion Center Office of Public Affairs at 865-2456 or the Directorate of Public Affairs, Air Force Engineering and Service Center, Tyndall AFB, Fla., 904-283-6114. The Resource Conservation and Recovery Act permit application is available for public review at the Gulfport-Harrison County Library, 21st Avenue, Gulfport,

Q-55,adv.19,19,29,3t

Agent Orange cleanup starts this summer

By GEORGE LAMMONS
SUN HERALD WRITER

Removal of what should be the last measurable traces of Agent Orange from the Naval Construction Battalion Center in Gulfport will begin this summer.

Seabee officers say a $5.4 million soil-decontamination project will allow them again to use the 18-acre tract of land where the hazardous herbicide was once stored.

Environmental officials say the operation will provide information that will be valuable in efforts to clean hazardous wastes in other areas of the country.

"We are very concerned about the Agent Orange," said Cmdr. David Marshall, executive officer of the Seabee Center.

Seabee officials will conduct a public briefing on the project at the Gulfport Westside Community Center tonight at 7.

The herbicide, used as a defoliant during the Vietnam War, contains dioxin, which has been linked to skin ailments, liver disorders and other ailments. Servicemen exposed to the herbicide have charged that it caused miscarriages and birth defects suffered by their wives and children.

The Air Force Emergency Services Center Laboratory, based at Tyndall Air Base in Panama City, Fla., tested the dioxin-contaminated soil last summer and will run the decontamination project this year.

During the testing, dioxin was detected in levels of as high as 200 to 300 parts per billion.

Air Force spokesman Jim Heaberg said the dioxin will be removed from about 9,000 tons of soil with a portable incinerator. The clean soil will returned.

The process is still experimental, but Heaberg said, "from everything we've seen so far we have come to the conclusion" that the project will be successful.

Besides, he said, "every step of the way there have been safety controls."

The portable incinerator will reduce the cost of the cleanup from $3,000 a ton to $350-$600 a ton. Without the portable incinerator the dirt would have to be removed and taken to an incinerator.

The process will be conducted around-the-clock and is scheduled to be finished by January 1987, he said.

The Seabee Center was the storage site for more than 800,000 gallons of Agent Orange between 1968 and 1977, when the herbicide was shipped to the Western Pacific and destroyed aboard the incinerator ship *Vulcanus*.

Contamination at the Seabee Center came from leaks in the 55-gallon drums that stored the herbicide.

Dioxin forms in Agent Orange when its two ingredients, two commercial herbicides, are mixed.

Heaberg said experiments last year indicated that none of the dioxin contaminated nearby streams, air or property off the base.

New Orleans
Times Picayune
Aug 11, 1986
Page 1

Toxic soil will burn at base in Gulfport

By The Associated Press

GULFPORT, Miss. — The Air Force will burn Agent Orange-contaminated soil at the Naval Construction Battalion Center in Gulfport as part of an experimental waste-disposal project.

The Environmental Protection Agency last week issued temporary permits to vaporize the dioxin-contaminated soil in portable incinerators and to monitor the surrounding air, land and water, spokesman Carl Terry said.

It will be the first time the process has been used, Terry said.

Air Force spokesman Maj. Jim Heaberg said the soil, on 18 acres of the Battalion Center, was contaminated by leaking Agent Orange tanks during the Vietnam War.

Dioxin is a contaminant sometimes formed during the manufacture of Agent Orange, an extremely toxic herbicide that was used by the Air Force to defoliate jungles in southeast Asia. Some servicemen who handled Agent Orange have said it is responsible for health problems and birth defects in their children.

About 880,000 gallons of Agent Orange were stored at the Seabee base from 1967 to 1977 before being incinerated at sea aboard the Dutch ship Vulcanus. The material to be incinerated is called concrete-stabilized soil and is made up of asphalt, pea gravel, sand, crushed shells, soil and cement, Heaberg said.

The $5.4 million disposal project is expected to have nationwide ramifications because it radically reduces the cost of disposal, Terry said. The closed thermal incinerator, which burns the soil twice, can reduce the cost from $3,000 a ton to $350 to $600 a ton because the contaminated material doesn't have to be transported, he said.

Both the incineration and the monitoring will take place 24 hours a day, seven days a week, Terry said. The incinerator will be brought to Gulfport aboard 18-wheelers beginning Aug. 4, Heaberg said. The process will

See BURN, A-6

Burn

From Page 1

continue until December or early January.

It will be monitored by the Navy and two private laboratories, Heaberg said. A permanent facility is in Arkansas, but there is no other portable incinerator, he said.

The actual incineration process is closed and the contaminants are vaporized by temperatures "several thousand degrees Fahrenheit," Heaberg said. There is no danger to residents or wildlife, he said.

"What comes out of the stack is basically carbon dioxide and water. There are no traces of contaminants," Heaberg said.

Air Force officials say no dangerous levels of dioxin have been found in the area outside the Navy site.

The Times-Picayune
The States-Item

ASHTON PHELPS
Chairman of the Board 1967-1983

Issued daily by The Times-Picayune Publishing Corp. at 3800 Howard Ave., New Orleans, La. 70140

ASHTON PHELPS JR.
President and Publisher

CHARLES A. FERGUSON
Editor

FRITZ HARSDORFF
Associate Editor, News

MALCOLM FORSYTH
Associate Editor, Editorials

YOUR OPINIONS | Letters

Toxic garbage: contaminants in the air

New Orleans

Your Aug. 11 front-page story, "Toxic soil will burn at base in Gulfport," includes at least one very misleading statement that deserves attention.

At issue is an Air Force project (with federal Environmental Protection Agency approval) to burn soil contaminated with Agent Orange in a mobile incinerator at the Naval Construction Battalion Center in Gulfport. Maj. Jim Heaberg, the Air Force spokesman, is quoted thus: "What comes out the stack is basically carbon dioxide and water. There are no traces of contaminants."

I located Maj. Heaberg at Tyndall Air Force Base near Panama City, Fla. A very helpful gentleman, he allowed that his statement was based "on good authority" and that he could "only pass on what I'm told."

I pointed out to him that incinerators are not atom smashers, and that if you burn a chlorinated product, which Agent Orange is, you get chlorine atoms out in some form. And as far as I know, having studied the issue, there's yet to be a system devised that doesn't put a good deal of those chlorine atoms out the stack and into the air.

They may go out as hydrogen chloride and contribute to acid rain. Or they may recombine with some of the carbon free radicals to form dioxin, one of the deadliest compounds known.

I certainly appreciate the need to find a way to dispose of our toxic garbage, but we have to be careful that our cures are not as bad or worse than the diseases.

Maj. Heaberg promised to get technical assistance for some of my questions and get back to me. On Aug. 21, my answer came. Mostly he told me that everything is "EPA approved" and that I should therefore not worry. I have dealt with the EPA too long to have such faith.

Then, after a brief description of the monitoring procedures that will be followed during the test burn, the major said: "During the actual run, for 90 days approximately, no monitoring will be required, once the equipment has proven successful and safe."

Astonishing! I'm sure Rollins, the notorious hazardous waste incinerator now under fire near Baton Rouge, would love to operate under such a system.

Though this "will be the first time the process has been used," according to your story, we're going to assume that everything runs perfectly after we go through a test burn? God save us. And "no traces of contaminants"? Don't you believe it.

Jerry Spair

Appendix C, Exhibit 5

THE SUN HERALD • A 11

THURSDAY, AUGUST 28, 1986

Waste incineration should be halted

With the incineration of dioxin-tainted soil at the Seabee Base in Gulfport, scheduled for early September 1986, it was only a matter of time before the other candidates would unfold their scenarios. (*Sun Herald* headline of Aug. 18 announcing Jackson County as a possible site for another "death valley" along with Montgomery County.)

The State Institute of Technology Development, along with many industrial giants and tacit approval from lesser groups, sanctioned such burning. And, no doubt, with eventual EPA agreement on the dioxon, our thoughtful citizens and environmentalists should immediately call halt and desist — no burning.

As the article stated, due to public outcry, the stationing of an at-sea incinerator ship in Pascagoula was stopped in June, 1985.

With portable incinerators on the horizon, don't be surprised if life becomes more precarious and, quality-wise, less endurable, if at all, as the right to breathe shatters and the right not to be "boiled" in hot oil, albeit slowly, deadly and ineluctably, becomes reality unfulfilled.

JOHN ASHTON GREENE
Rt. 4, Pass Christian

Sun Herald 11 Sept 96

Dioxin incinerator headed to Gulfport

Dioxin incineration equipment will begin arriving at the Naval Construction Battalion Center in Gulfport early next week.

Maj. Jim Heaberg of Tyndall Air Force Base in Florida said a nine-truck caravan carrying a portable incinerator, should reach the Seabee Center sometime Tuesday afternoon.

Heaberg said it will be assembled by the end of October or the first of November.

The Air Force is responsible for the cleanup of dioxin-contaminated soil at the Seabee Center. A 12-acre site was contaminated when 843,000 gallons of the herbicide, Agent Orange, was stored there during the 1970s. Dioxin is a byproduct of Agent Orange, a defoliant used in Vietnam.

Gulfport Sun Herald September 18, 1986

Dioxin-purging machine arrives in Gulfport

By GEORGE LAMMONS
SUN HERALD WRITER

Thirteen tractor-trailer trucks were needed to carry the equipment that will purge the dioxin from the contaminated soil at the Naval Construction Battalion Center in Gulfport.

The caravan arrived at the Seabee base Wednesday afternoon, and initial unloading was to start immediately.

Air Force Capt. Terry Stoddart, project spokesman, said assembly and testing of the portable incinerator will require about 60 days. The soil-cleansing process is expected to start in mid- to late December and will take about 90 days with around-the-clock burning.

The Air Force Engineering and Services Center Laboratory at Tyndall Air Force Base, Fla., is responsible for the $5.4 million cleanup of the contaminated 12 acres. An estimated 9,000 tons of soil have to be baked to get rid of the dioxin.

The soil was contaminated during and after the Vietnam War when the defoliant, Agent Orange, leaked from some of the 17,000 barrels stored at the base.

Dioxin is a by-product of Agent Orange.

The Seabee base incineration project, like other dioxin-neutralizing projects, is still experimental, al-

Please see DIOXIN, A-4

Dioxin

Continued from A-1

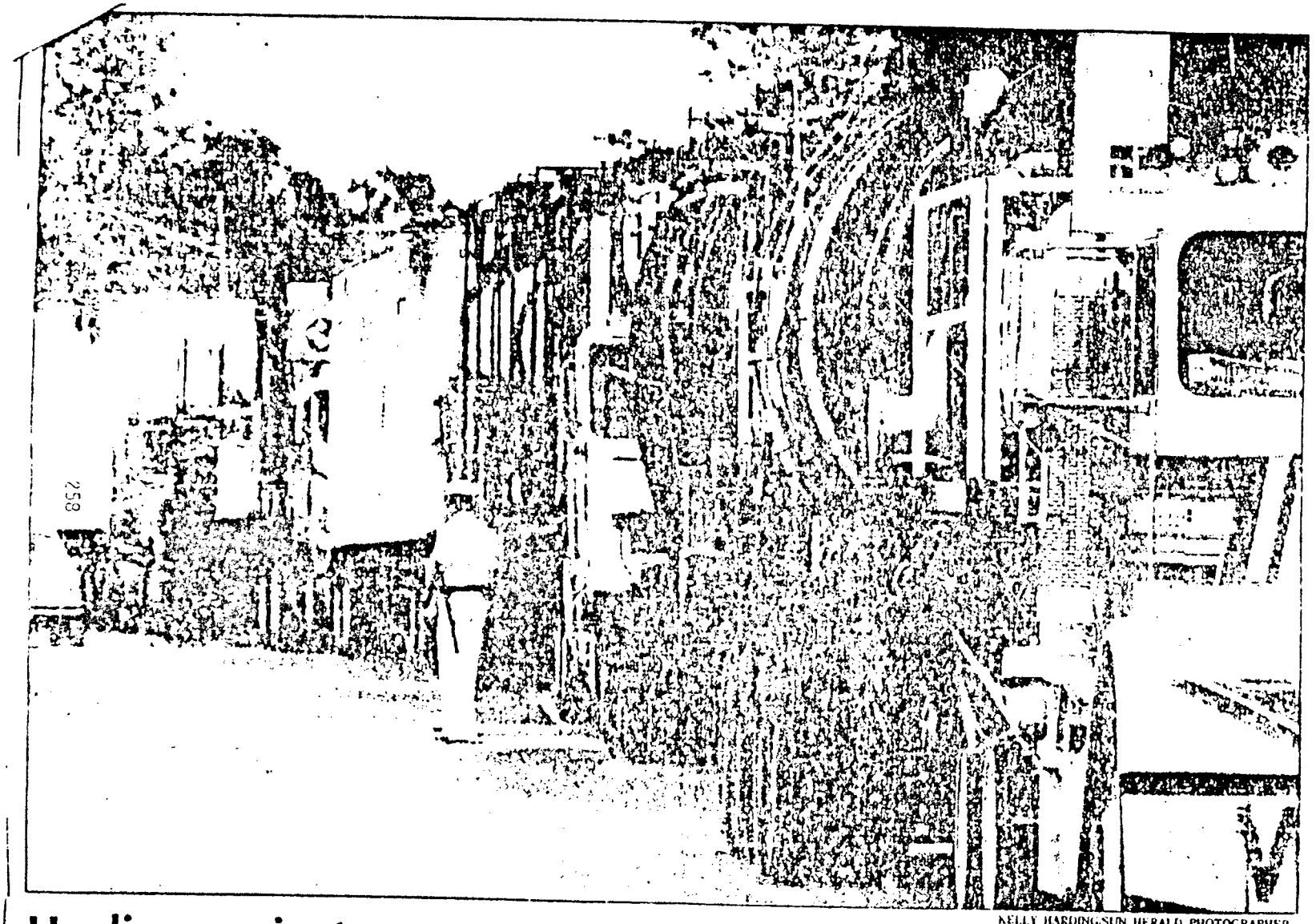
though incineration has proven effective in decontaminating dioxin-laden soil in other instances.

The gas-fired incinerator used at the Seabee Center has been tested in Eldorado, Ark., and similar systems have been used by the U.S. Environmental Protection Agency in cleanups of civilian sites.

However, Capt. Terry Stoddart, an Air Force spokesman, said the Gulfport cleanup will be the first large-scale use of the furnaces. The incinerators used in the EPA projects had only a fourth of the capacity of the one that will be used at the Seabee base.

Stoddart said the experiment is necessary to see if the system is reliable, cost effective and efficient in the removal of hazardous materials from the soil.

The Air Force will also experiment with a chemical dioxin-removal method. The chemical will be applied to contaminated concrete slab, contaminated soil and contaminated soil placed in a tank. Stoddart said that after the chemically-decontaminated soil and concrete have been tested they also will be burned.



KELLY HARDING/SUN HERALD PHOTOGRAPHER

Hauling a giant oven

Sept 18, 1996

It took 13 tractor-trailer trucks to transport the portable dioxin-burning incinerator to the Seabee base in Gulfport. Story on A-1.

Appendix C, Exhibit 8

Gulfport Sun Herald, September 18, 1986

Lasting Agent Orange effects detected, study says

By MATTHEW PURDY
KNIGHT-RIDDER NEWSPAPERS

WASHINGTON — A team of doctors Wednesday announced what they termed a breakthrough in the detection of long-term dioxin contamination of Vietnam veterans who were exposed to Agent Orange, the controversial defoliant used by the U.S. military in Southeast Asia.

In a three-year pilot study by doctors in the United States and Sweden, veterans who had been exposed to heavy doses of Agent Orange were found to have dioxin levels on an average of 10 times the levels found in veterans who were not exposed to the defoliant or who did not serve in Vietnam.

Dioxin has been linked to a range of possible health effects including skin disorders, liver and kidney diseases, cancer and birth defects. Veterans groups have estimated that 2 million veterans were exposed to the chemical between January 1962 and February 1971 when 18.85 million gallons of the herbicide were sprayed in South Vietnam.

The study is considered significant

Please see EFFECTS, A-4

Effects

Continued from A-1

because it offers proof that dioxin can be detected in both the blood and fatty tissue of veterans who were exposed to Agent Orange. That information, the study's sponsors said, can be used to establish a correlation between the contamination and diseases now suspected to be caused by dioxin contamination.

The accurate detection of dioxin and its relationship to diseases has been a missing link in both medical research and legal claims filed against the government by veterans who believe they were exposed to Agent Orange. In addition, this test can also be used in the study of other cases of dioxin exposure, such as in Times Beach, Mo., where residents were believed contaminated with dioxin contained in road oil used in that town.

Allen Falk, chairman of the New Jersey Agent Orange Commission, which sponsored the study, said "the Agent Orange issue is not dead and should not be dead. We now have the means to find the answer to the Agent Orange question."

Commission officials said that it would take several years before widespread testing of veterans could be started because of the expense of the tests and the small number of laboratories in the world that could perform the tests.

The study was conducted by doctors and scientists at the Rutgers University, the New Jersey College of Medicine and Denistry and the University of Umea in Sweden, where the tests were performed. The results were announced Wednesday in Washington and at a medical conference in Japan.

The study tested 27 veterans who were chosen out of a pool of more than 3,000 veterans. Of the 27 veterans, 10 had received heavy exposure to dioxin, 10 were Vietnam veterans but were not exposed to dioxin and seven were Vietnam era veterans but were never stationed in Southeast Asia.

Blood and fatty tissue samples from the 10 who had received heavy exposure contained 46 to 49 parts per trillion of dioxin, while the contaminant was found in samples of the other veterans at levels of between four and nine parts per trillion, according to Michael Gochfeld, a doctor involved in the study.

Gochfeld said the "background" level of dioxin, or the amount of dioxin found in the general population, is five parts per trillion.

Seabee Courier

Gulfport, Mississippi
Home for the Atlantic Seabees

Vol. 23 No. 16 U.S. Naval Construction Battalion Center, Gulfport, Ms., 39501 September 19, 19

260

Air Force begins testing dioxin removal technology at NCBC

HQ AFESC, Gulfport, Miss.-- The Air Force will begin large scale testing of dioxin removal technology this month at the Naval Construction Battalion Center here, a former storage site used in the 70s for the Vietnam-era defoliant herbicide orange.

The first components of the incinerator arrived here this week. Three over-sized flatbed tractor-trailer rigs transported the components from the manufacturer in White Bluff, Tenn., accompanied by six semi-trailers of additional equipment. Set-up and installation will take approximately sixty days.

The $5.4 million research project, managed by the Air Force Engineering and Services Center (AFESC) Laboratory at Tyndall AFB, Panama City, Fla., is designed to discover an efficient, cost effective method of removing contamination from soil. The project has been sanctioned and closely coordinated with officials from the Enviromental Protection Agency.

Activities began last year with technology demonstrations, processing small quantities of soil from the 12-acre site to initially evaluate various methods. The large scale test will involve processing some 9000 tons of soil, using a two-stage incineration method, chosen as the most successful for the type of soil at NCBC. The test will determine whether or not the equipment can handle the large quantities of soil necessary to reclaim contaminated land, returning it to a useful condition.

Scientists from the AFESC facility, the Air Force's lead laboratory in environmental research and development, estimate completing the test early next year.

During this large scale test, scientists will also conduct another experiment, focused on removing contamination from concrete. A small concrete slab on the site, found to be contaminated, will be used to test an "in-place" method of removing dioxins using a special chemical wash. Pulverized concrete samples will be tested in an on-site laboratory, and then, for safety, run through the soil processing equipment to ensure dioxin removal.

The Air Force has been monitoring the site since the 70s. The contamination is completely contained, and sampling to date has revealed no health threat to nearby communities or wildlife in the area. The site is not used, and fenced and posted off-limits.

More than 17,000 55 gallon drums, formerly stored at NCBC, were safely incinerated in 1977, aboard an incineration ship at sea. The soil contamination resulted from small spills, most measuring less than six inches in diameter, from leakage of the drums during storage and while pumping the defoliant into large tanks for transportation to the ship.

The AFESC laboratory is responsible for the Air Force's Environmental Quality Program, developing methods and techniques to detect and abate the impact of pollutants which have, or may result from the deployment of Air Force systems.

Appendix C, Exhibit 9

Gulfport Sun Herald November 11, 1986

Dioxin burning to start

By GEORGE LAMMONS
STAFF WRITER

■ The incinerator that will purge dioxin contamination from 9,000 tons of soil at the Naval Construction Battalion Center in Gulfport is in place and initial testing has started.

In about two weeks it will cook its first batches of dirt to make sure the process actually gets rid of the dioxin. And after laboratories have analyzed that soil — a six-week process — the incinerator will work 24 hours a day for 90 days to cleanse the rest of the soil at the 12-acre site.

The process should be complete and the incinerator removed by the end of June.

Air Force Maj. Jim Heaberg, project spokesman, said soil will be removed from the contaminated 12-acre site to depths varying from 6 inches to about 18 inches. The Air Force Engineering and Services Center Laboratory at Tyndall Air Force Base, Fla. is responsible for the $5.4 million project.

The soil was contaminated by leaks Agent Orange during and after the Vietnam War, when 17,000 barrels of the defoliant were stored at the base. Dioxin is a by-product of Agent Orange.

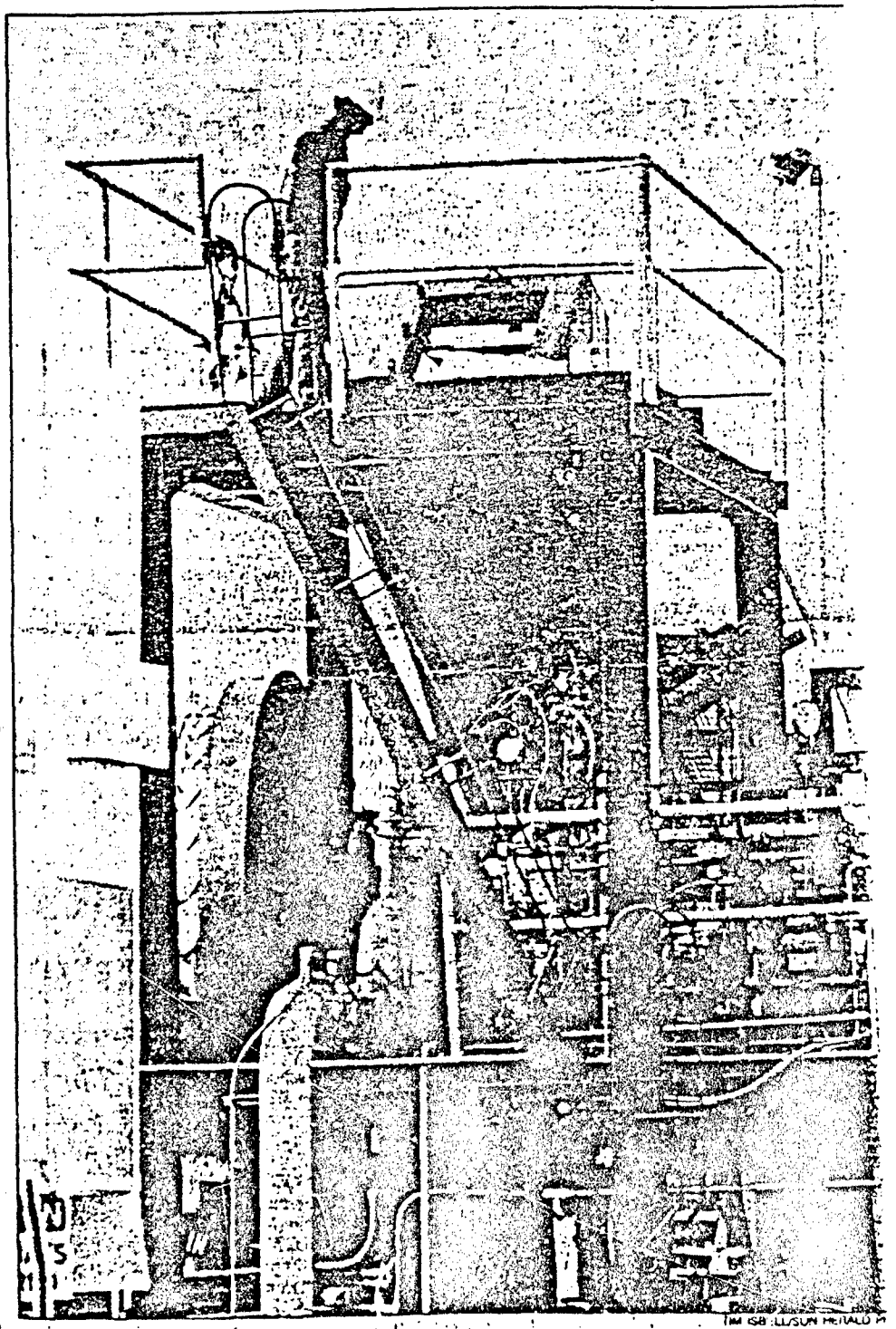
The incinerator, part of a new hazardous waste removal process, arrived unassembled at the Seabee Base in September on 13 tractor-trailers.

Heaberg said the portable incinerator is still experimental because it has never been run round-the-clock for 90 days.

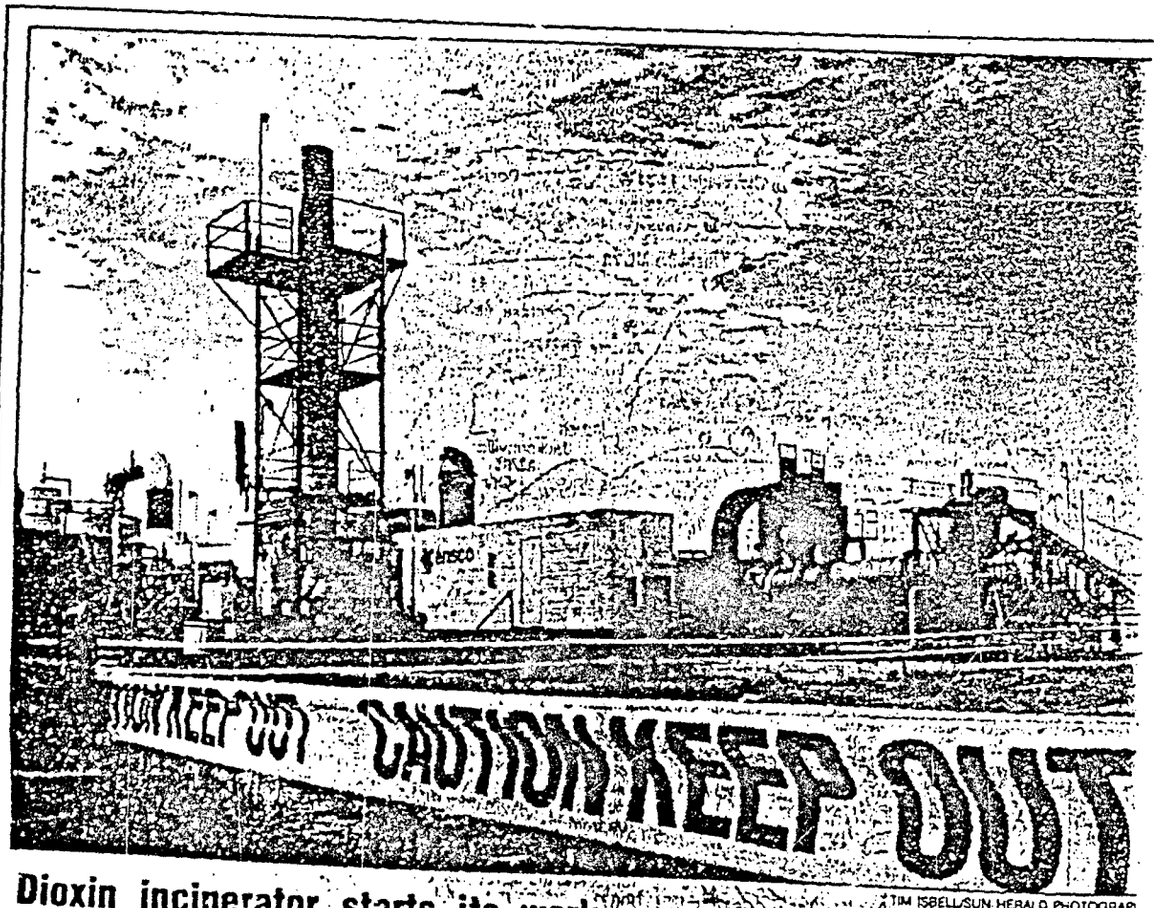
However, he also said the system is expected to be effective, based on similar technology that worked in an Arkansas experiment. Another similar system, tested at Times Beach, Mo., has the U.S. Environmental Protection Agency and Sierra Club stamps of approval.

And, if it works, the portable system will also be more economical than conventional methods. Without the portable incinerator, the contaminated dirt has to be sent to an approved landfill or baked in a stationary incinerator.

Heaberg said the project would cost about $6,000 a ton to send the contaminated soil to a stationary incinerator in Texas. The cost for the portable incinerator will be $400 to $700 per ton.



A workman checks out the incinerator which will be used to burn 9,000 tons of dioxin in C



TIM ISBELL/SUN HERALD PHOTOGRAPH

Dioxin incinerator starts its work

Testing of a portable dioxin incinerator began Monday in Gulfport. If tests are successful, the machine will be used to purge 9,000 tons of soil the deadly chemical. Details, C-1.

November 11, 1986

EDITORIALS

Clearing away dioxin residue in Gulfport

Gulfport Sun-Herald Nov 12, 1986

An unclosed chapter of the Vietnam war, as some television viewers were reminded Monday night, is the personal injuries some veterans are suffering and others will suffer from exposure to Agent Orange, the defoliant used to clear away the jungles. The physical damages sometimes are many years in developing. Gulfport is a part of the Agent Orange story.

On the same day as the television movie about that suffering and veterans' efforts to obtain recognition of their problems and get help, a footnote to the Agent Orange story was being written at the Naval Construction Battalion Center. The Air Force is undertaking a $5.4 million project to remove traces of the chemical from the building.

During the period while more than 840,000 gallons of the defoliant were stored at the CB base from 1967 to 1977, some of the barrels leaked dioxin, a toxic substance rushed into combat area use before all of its long-term effects were known or at least before the servicemen and the general public were told of those effects. Had the full dangers been known, the barrels stored at Gulfport undoubtedly would have been treated with much greater care.

Disposal of the poisons that remained at the base after the war was accomplished by incineration aboard the Dutch ship Vulcanus in the open waters of the Pacific Ocean nine years ago. One safety feature about the location of the burning is that if there were any poisons released in the stack emissions, the release took place in an isolated area, where the likelihood of any human contamination was minimal. That safety factor of isolation is not present in the current project.

The portable incinerator is different from the one aboard the Vulcanus, but it should be remembered that the ship did become contaminated in the burning at sea and had to be decontaminated afterwards. The Air Force is convinced that the portable incinerator now being tested at the CB site is capable of decontaminating the soil over 12 acres without endangering the population living near the base. Stack emissions, spokesmen say, will contain nothing worse than carbon dioxide and water.

The project generates mixed emotions. On the one hand, it is reassuring that the services recognize the soil has been contaminated by the leaks and that there is a health hazard in not taking action to cleanse the site. At the same time, this particular method is an experimental one.

Because of the experimental nature and because of the incinerator's proximity to populated areas, the officials in charge have a heavy responsibility to monitor every step of the process. The monitoring must be continual and careful throughout the 24-hours-per-day the machine will be working. Inspectors must assure that whatever is discharged into the air is not harmful to local residents and also must make certain that when the process is completed, what remains is clear of dangerous chemicals.

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APPENDIX D

REQUEST APPLICATION AND STATE AUTHORIZATION FOR POTW PERMIT AT NCBC

The items contained in this appendix include various forms and submittals to the State of Mississippi Bureau of Pollution Control to (POTW). the final POTW permit is also included These documents were reproduced from the best available copies. Due to poor original legibility, the legibility of the microfiche editions is also poor. Persons requiring the information contained in this appendix may write to the technical libraries listed below to obtain photocopied versions of the appendix. A nominal charge will be levied to cover reproduction and archival costs. Please be prepared to provide the following information:

Report Title: Full-Scale Incineration System Demonstration Verification Test Burns at the Naval Construction Battalion Center, Gulfport, Mississippi: Treatability Tests

Report Number: ELS-TR-88-61, Volume: II, Part: 2, Appendix: D

Send inquiries to:

Technical Library
Engineering and Services Laboratory
Tyndall Air Force Base, FL 32403

or

Technical library
Idaho National Engineering Laboratory
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-2300

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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Appendix D, Exhibit 1

Dark

Sent EJ

For Agency Use
Application Number

Date Received

STATE OF MISSISSIPPI
BUREAU OF POLLUTION CONTROL
P. O. BOX 10385
JACKSON, MISSISSIPPI 39209

APPLICATION FOR A STATE OPERATING PERMIT

(Please print or type)

1. Name of Applicant: Capt. T. L. Stoddart - United States Air Force Engineering Services Center

2. Mailing Address of Applicant:

   Number & Street (P. O. Box): HQ AFESC/RDVW

   City: Tyndall AFB State: FL Zip: 32403

3. Applicant's Authorized Agent:

   Name & Title: M. D. Williams, Project Mgr.

   Number & Street (P. O. Box): EG&G Idaho, P.O. Box 1625

   City: Idaho Falls State: ID Zip: 83415

   Telephone Number: (208) 526-1763

4. Facilities Location:

   Number & Street: Naval Construction Battalion Center

   City: Gulfport County: Harrison

5. Nature of Business: EPA permitted demonstration of a hazardous waste incinerator.

6. Do you Discharge Wastewater to a POTW? X Yes _____ No
   If "Yes" Continue, if "No" go to Item 10.

   Name of POTW Receiving Wastewater: Harrison County Waste Water Management District

   Number & Street (P. O. Box): 3409 8th Ave. Phone (601) 868-8782

   City: Gulfport County: Harrison 39501

Rev.10/25/84-jcs

7. Discharge Type and Occurrence:

A. Type of Discharge: X Continuous; If Continuous, 7700 Gallons per Day (Maximum) POTW

___ Batch

B. Discharge Occurrence: 7 Days per Week

C. Discharge Occurrence: X Jan. X Feb. X Mar. ___ Apr. (1987)

___ May ___ Jun. ___ July ___ Aug.

v Sept. v Oct. v Nov. v Dec. (1986)

8. If Batch: A. N/A Thousand Gallons per Discharge

B. N/A Hours per Day

C. N/A Discharge Occurrences per Day

9. Maximum Period of Flow: From Oct/1985 (Month) to March/1987 (Month)

10. Facility Water Use:

Estimate average volume in thousand gallons per day for the following types of water usage at this facility.

Noncontact Cooling: N/A

Boiler Feed: 0.7 tg/d

Process (Including Contact Cooling): 49.7 tg/d

Sanitary: 0.5 tg/d (Shower/Wash basin only)

Other: ___

Total: 50.9 tg/d

11. List All Facility Discharges: ___

Other water losses (surface water, product consumption, evaporation). Indicate volume in thousand gallons.

Steam - Stack:	42.5 tg/d
- Boiler Blowdown:	0.7 tg/d (evaporates in ash drag)
POTW - Process:	7.2 tg/d
Sanitary - Shower/Wash basin:	0.5 tg/d

12. Give narrative description of process(es) producting discharge, or in the case of no discharge, that generates wastewater.

A hazardous waste incinerator will operate continuously for four (4) months and intermittently for 3 months. It will process soil contaminated with chlorinated herbicides, The detruction will release chlorine which will be scrubbed with water. The resultant HCL will be neutralized and filtered prior to discharge to POTW (Ref. Attached Figure)

continued on attached.

13. List raw materials used:

Boiler Feedwater Chemicals (MSD sheets attached), $CaCO_3$, soil, natural gas, & municipal water.

14. Effluent Characteristics:

A. You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall to the city sewer. If your facility does not have a discharge indicate so and disregard.

Parameter	Maximum Daily Value	Maximum 30 Day Value	Long Term Average Value
BOD_5	None	None	None
COD	None	None	None
TSS	None	None	None
Ammonia	None	None	None
Oil & Grease	None	None	None
pH	6-8	6-8	6-8

B. Review the substances listed in Table One and indicate which of these substances you have reason to believe may be in your discharge. For instance you may use solvents or Biocides that contain one or more of the indicated solvents. For each substance indicated you must perform at least one anlysis and report results.

Note on A. The discharge will contain a maximum of 400 lbs. of salt ($CaCl_2$) on any given day with a daily average of 100 - 150 lbs./day only during the operation period of 4 - 5 months.

TABLE 1

65 Toxic Pollutants Listed in Consent Decree and Referenced in 307 (a) of the CWA of 1977

Believe Present		Concen.
No	Acenaphthene	ND*
	Acrolein	
	Acrylonitrile	
	Aldrin/Dieldrin	
	Antimony & compounds	
	Arsenic & compounds	
	Asbestos	
	Benzene	
	Benzidine	
	Beryllium & compounds	
	Cadmium & compounds	
	Carbon tetrachloride	
	Chlordane	
	Chlorinated benzenes	
	Chlorinated ethanes	
	Chlorinalkyl ethers	
	Chlorinated naphthalene	
	Chlorinated phenols	
	Chloroform	
	2-Chlorophenol	
	Chromium & compounds	
	Copper & compounds	
	Cyanides	
	DDT & metabolities	
	Dichlorobenzenes	
	Dichlorobenzine	
	Dichloroethylenes	
	2,4-Dichlorophenol	
	Dichloropropane & Dichloropropene	
	2,4-Dimethylphenol	
	Dinitrotoluene	
	Diphenylhydrazine	
	Endusolfan & metabolities	

Believe Present		Concen.
No	Endrin & Metabolities	ND*
	Ethylbenzene	
	Flouranthene	
	Haloethers	
	Halomethanes	
	Hepthachlor & metabolities	
	Hexachlorobutadiene	
	Hexachlorocyclopentadiene	
	Hexachlorocylohexane	
	Isophorone	
	Lead & compounds	
	Mercury & compounds	
	Naphthalene	
	Nickel & compounds	
	Nitrobenzene	
	Nitrophenols	
	Nitrosamines	
	Pentachlorophenol	
	Phenol	
	Phthalate esters	
	Polychlorinated byphenyls(PCB)	
	Polynuclear aromatic Hydrocarbons	
	Selenium & compounds	
	Silver & compounds	
	2,3,7,8-Tetrachlorodibenzo-p-dioxine (TCDD)	
	Tetrachloroethylene	
	Thallium & compounds	
	Toluene	
	Toxaphene	
	Trichloroethylene	
	Vinyl chloride	
	Zinc & compounds	

*ND - Not Detectable

List any other toxicants known or anticipated to be present in the discharge:

Note to A. & B. - Analyses will be performed during test burn (performed 2-3 weeks prior to continuous operation) and those results will be forwarded.

15. Treatment Units:

A. Do you provide treatment for your wastewater? X Yes ____ No

B. If yes, list and describe each treatment unit and attach a line schematic of the treatment system indicating each treatment unit and a water balance.

Neutralization of acids followed by carbon filters to insure organic removal. A sand filter is optional if particulate is present. (Ref. attached Figure)

I certify that I am familiar with the information contained in this application and that to the best of my knowledge and belief such information is true and correct.

Harry D. Williams	Principle Program Specialist
Printed Name of Applicant's Authorized Agent	Title
7/16/86	Harry D. Williams
Date Application Signed	Signature of Authorized Agent

Continuation of 12.

This discharge will be to an existing sewer line on the Naval Construction Battalion Center (NCBC) and will increase the present average daily discharge of 250,000 gal. to 258,000 gal. during continuous operation of the equipment. This discharge will only occur during a 4 - 5 month period. A minimal discharge of sanitary and process water of 500 gal/day will occur approximately 3 months prior to continuous operation and for 1 month following operation.

USAF/ Ltr to Harrison County

CHARACTERIZATION OF WASTE WATER DISCHARGE TO POTW

A hazardous waste incinerator will operate continuously for four (4) months and intermittently for 3 months at the Naval Construction Battalion Center (NCBC), Gulfport, MS. This operation is scheduled to occur during September 1986 to March 1987. The incinerator will process soil contaminated with chlorinated herbicides, and their destruction will produce hydrochloric acid in the scrubber water. This acid will be neutralized with $CaCO_3$ resulting in a brine solution.

A part of the process is a waste heat boiler which will produce a stream of boiler blowdown water. This stream will be exaporated in cooling the ash drag and therefore will not be discharged to the NCBC sewer system. A small stream of sanitary (shower/wash basin) water is included. (Reference attached Figure.)

TABLE 1: Daily Volumes of Process Discharge to NCBC Sewer System

Source	Intermittent (3 mos.) - gal.	Continuous (4 mos.) - gal.
Process System	< 100	7,200
Sanitary	500	500
Total	< 700	7,700

Thus, the largest discharge is 7,700 gal/day and would increase the NCBC discharge from approximately 250,000 gal/day to 258,000 gal/day.

TABLE 2: Effluent Characteristics

Parameter	Maximum Daily Value	Average Daily Value
BOD	None	None
Suspended Solids	None	None
Dissolved Solids*	400 lbs.	100 - 150 lbs.
Ammonia	None	None
Oil & Grease	None	None
pH	6-8	6-8

*Principle constituent is $CaCl_2$

BLE 3: Toxic Contaminants

Believe Present		Concen.	Believe Present		Concen.
No	Acenaphthene	ND*	No	Endrin & Metabolities	ND*
	Acrolein			Ethylbenzene	
	Acrylonitrile			Flouranthene	
	Aldrin/Dieldrin			Haloethers	
	Antimony & compounds			Halomethanes	
	Arsenic & compounds			Hepthachlor & metabolities	
	Asbestos			Hexachlorobutadiene	
	Benzene			Hexachlorocyclopentadiene	
	Benzidine			Hexachlorocylohexane	
	Beryllium & compounds			Isophorone	
	Cadmium & compounds			Lead & compounds	
	Carbon tetrachloride			Mercury & compounds	
	Chlordane			Naphthalene	
	Chlorinated benzenes			Nickel & compounds	
	Chlorinated ethanes			Nitrobenzene	
	Chlorinalkyl ethers			Nitrophenols	
	Chlorinated naphthalene			Nitrosamines	
	Chlorinated phenols			Penachlorophenol	
	Chloroform			Phenol	
	2-Chlorophenol			Phthalate esters	
	Chromium & compounds			Polychlorinated byphenyls (PCB)	
	Copper & Compounds			Polynuclear aromatic	
	Cyanides			Hydrocarbons	
	DDT & metabolities			Selenium & compounds	
	Dichlorobenzenes			Silver & compounds	
	Dichlorobenzine			2,3,7,8-Tetrachlorodibenzo-p-dioxine (TCDD)	
	Dichloroethylenes			Tetrachloroethylene	
	2,4-Dichlorophenol			Thallium & compounds	
	Dichloropropane & Dichloropropene			Toluene	
	2,4-Dimethylphenol			Toxaphene	
	Dinitrotoluene			Trichloroethylene	
	Diphenylhydrazine			Vinyl chloride	
	Endusolfan & metabolities			Zinc & compounds	

* ND - Not Detectable

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209
(601) 961-5171

September 9, 1986

Captain T. L. Stoddart
Commanding Officer
Naval Construction Battalion Center
Code Orange
Gulfport, Mississippi 39501

Dear Captain Stoddart:

Re: Pretreatment Permit No. PT90249
United States Air Force
(Naval Construction Battalion Center)

Shortly, the Mississippi Pollution Control Permit Board intends to issue to the above facility a State of Mississippi Pretreatment Permit. The enclosed draft permit contains conditions which we intend to incorporate as part of your final permit.

Please note the effluent limitations, schedule of compliance, monitoring requirements, and monitoring reporting dates in Part I of the permit.

Please be advised that this permit does not relieve the permittee from complying with any requirements which the Publicly Owned Treatment Works (POTW) Authority may deem necessary as a prerequisite to the use of the Authority's sewage system and associated treatment works. Additionally, the POTW Authority is being given an opportunity to comment on the enclosed draft permit.

If you have any comments concerning the information transmitted herewith, please notify this office in writing by September 22, 1986.

Respectfully,

Wm. Stephen Spengler

Wm. Stephen Spengler, P. E., Assistant Coordinator
Industrial Wastewater Control Section

WSS:els
Enclosures
cc: Mr. Harry D. Williams (w/enclosure)

Appendix D, Exhibit 4

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE ENGINEERING AND SERVICES CENTER
TYNDALL AIR FORCE BASE, FL 32403

19 SEP 1986

Wm. Stephen Spengler
Assistant Coordinator
Industrial Wastewater Control Section
Mississippi Department of Natural Resources

Dear Mr. Spengler:

The U. S. Air Force with the support of EG&G, Idaho, and their subcontractor ENSCO, Inc., has reviewed the draft State of Mississippi Pretreatment Permit which was received 10 September 1986. We have the following comments:

1. Part 1 A Monitoring. We do not believe it is necessary to monitor the normal daily discharge for both dioxin and the constitutients of Herbicide Orange: 2,4,5-T and 2,4-D. The rationale is as follows:

a. The system will first undergo three test burns, approximately two to three hours each, using the most contaminated soil. Samples of all effluents will be taken. The water samples will be analyzed for Section 304(h) of the Federal Water Pollution Control Act and RCRA Appendix 8. During this analysis and evaluation period (four to six weeks), the system will be shut down and the water generated will be held in storage tanks. If the data shows the water meets the requirements, it will then be released to the POTW as part of the start up of normal operations.

b. Prior to normal operations, operator procedures, alarms and automatic shutdown mechanisms will be set to maintain operating parameters established by the test burns. Treatment will occur only when those parameters are maintained. Since operation after the test burns will treat soil with less contamination and the water from the test burn has no contaminants, it is reasonable to state that the subsequent water would not be contaminated.

c. pH will be maintained at 5.5 to 9.5 by the addition of $CaCO_3$. pH measurements will be made prior to discharge to insure that the required pH is maintained. In addition, 2,4-D and 2,4,5-T will be monitored because:

(1) 2,4,D and 2,4,5-T are present in the soil in significantly higher concentrations, i.e., 2400 ppm vs 600 ppb, and

(2) water solubility of dioxin is extremely low, but 2,4-D and 2,4,5-T are both soluble.

It is our request that the requirement to monitor 2,3,78 TCDD (dioxin) during normal operation be deleted following evaluation and approval of the test burn data.

2. Part 1C.1.(b). Statement should read, "...with pH lower than 5.5 unless...."

3. Part II B.2. The test procedures used by the analytical laboratory will be specified by EPA-SW846, the Certified Laboratory Program (CLP), or industry standards that are recognized by EPA. If the State of Mississippi has any requirements that are additional to these standards, we need to be so informed.

T L Stoddart

Terry L. Stoddart, Capt, USAF, BSC
Project Officer

cc: EG&G, Idaho, (H. D. Williams)
Harrison County Wastewater Management District

Appendix D, Exhibit 5

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209
(601) 961-5171

September 22, 1986

Captain T. L. Stoddart
Commanding Officer
Naval Construction Battalion Center
U.S.A.F. Project Trailer
Code Orange
Gulfport, Mississippi 39501

Dear Captain Stoddart:

Re: Pretreatment Permit No. PT90249
Naval Construction Battalion Center

Shortly the Mississippi Natural Resources Permit Board intends to issue the referenced State of Mississippi Pretreatment Permit. The enclosed draft permit contains conditions which we intend to incorporate as part of your final permit. Also enclosed is a Public Notice dated September 30, 1986, which is the beginning of a 30-day comment period during which the general public's input and comments are invited. If you have not already done so, you are also invited to submit written comments by no later than October 30, 1986. A final decision regarding the proposed issuance will be made at the end of the comment period.

Should you have any questions or wish to discuss this matter, please contact me at 601-961-5171.

Sincerely,

Wm. Stephen Spengler

Wm. Stephen Spengler, P. E., Assistant Coordinator
Industrial Wastewater Control Section

WSS:cm
Enclosures
cc: Mr. Harry D. Williams (w/enclosure)

DRAFT

PUBLIC NOTICE

Mississippi Natural Resources
Permit Board
P. O. Box 10385
Jackson, Mississippi 39209

Public Notice No. 86-MS00315 September 30, 1986

NOTICE OF APPLICATION FOR STATE OF MISSISSIPPI PRETREATMENT PERMIT

United States Air Force, Engineering Services Center, HQ, AFESC/RDVW, Tyndall AFB, Florida, 32403, has applied for a State of Mississippi Pretreatment Permit, Application Number PT90249, to discharge treated process wastewater into the Harrison County Wastewater Management District's Gulfport Wastewater Treatment Facility. The applicant's operation is the incineration of Agent Orange contaminated soil at the Naval Construction Battalion Center in Gulfport, Mississippi. One proposed discharge is described in the application.

On the basis of preliminary staff review and application of the Mississippi Air and Water Pollution Control Act (Sections 49-17-1 et. seq., Mississippi Code of 1972), the Mississippi Natural Resources Permit Board proposes to issue a permit to operate a wastewater disposal facility at the above location(s), subject to specific limitations and conditions. These proposed determinations are tentative.

Persons wishing to comment upon or object to the proposed determinations are invited to submit same in writing to the Permit Board address above no later than October 30, 1986. All comments received prior to that date will be considered in theformulation of final determinations regarding the application. The permit application number should be placed on the envelope next to the above address and also at the top of the first page of comments. A public notice hearing may be held where the Permit Board finds a significant degree of public interest in a proposed permit or group of permits.

Additional details about the application and the proposed determination, a sketch showing the exact location of the discharge and additional information of hearing procedure is available by writing or calling the Permit Board. A copy of the draft permit is also available from the Permit Board. The application, comments received, and other information are available for review and copying at 2380 Highway 80 West, Jackson, Mississippi, between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday.

Please bring the foregoing to the attention of persons whom you know will be interested.

EGG.
470 2

HARRISON COUNTY WASTEWATER MANAGEMENT DISTRICT

P.O. Box 4253
GULFPORT, MISSISSIPPI 39502
Telephone (601) 868-8752

August 29, 1986

Mr. Steve Spengler
Bureau of Pollution Control
P.O. Box 10385
Jackson, MS 39209

Dear Steve:

After reviewing the proposed Herbicide Orange Incineration project, including the data supporting the premise that the project will safely decontaminate the NCBC, the Harrison County Wastewater Management District has no objection to the disposal of the projects wastewater into the Gulfport sanitary sewer.

It is understood that this water will be pretreated for suspended solids removal and ph adjustment, and then passed through dual activated carbon cylinders. The water will then be held in storage tanks pending laboratory analysis for 2, 3, 7, 8 - TCDD.

It is further understood that any wastewater created during decontamination of project personnel will be passed through the incineration process and not discharged to the Gulfport sanitary sewer.

It is expected that, it at any time, 2,3,7,8-TCDD is detected in the wastewater, that the carbon system will be regenerated and that the contaminated wastewater be retreated rather than discharged.

The Harrison County Wastewater Management District would like to thank Captain Terry Stoddart for his cooperation in providing the District with the information with which to make an informed decision.

Very truly yours,

Harry Griffith
Executive Director

HG/cei
cc: Commanding Officer
Naval Construction Battalion Center
Gulfport, MS
Attention Code 470

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209
(601) 961-5171

November 13, 1986

Captain T. L. Stoddart
Commanding Officer
Naval Construction Battalion Center
U.S.A.F. Project Trailer
Code Orange
Gulfport, Mississippi 39501

Dear Captain Stoddart:

Re: Pretreatment Permit No. PT90249

Enclosed is Pretreatment Permit Number PT90249, which is hereby issued to United States Air Force Engineering Services Center. Please note the effluent limitations, schedule of compliance, monitoring requirements, and monitoring reporting dates found in this permit.

This permit is issued in accordance with the provisions of the Mississippi Air and Water Pollution Control Law (Sections 49-17-1, et. seq., Mississippi Code of 1972), and the regulations and standards adopted and promulgated thereunder.

Please be advised that this permit does not relieve the permittee from complying with any requirements which the Publicly Owned Treatment Works (POTW) Authority may deem necessary as a prerequisite to the use of the Authority's sewage system and associated treatment works.

If United States Air Force Engineering Services Center desires that a Permit Board hearing be held regarding this permit, it should make written application to the Board within thirty (30) days after receipt of this notice; otherwise, the terms, conditions and limitations in the permit shall become final.

If you have any questions, please contact us.

Sincerely,

Wm. Stephen Spengler, P. E., Assistant Coordinator
Industrial Wastewater Control Section

WSS:els
Enclosure
cc: Mr. Harry Williams
Mr. Warren V. Foster, Jr. (w/enclosure)

State of Mississippi
Water Pollution Control
PERMIT

TO OPERATE A WASTE DISPOSAL SYSTEM IN ACCORDANCE

WITH NATIONAL AND STATE PRETREATMENT STANDARDS

THIS CERTIFIES THAT

UNITED STATES AIR FORCE ENGINEERING SERVICES CENTER
(Naval Construction Battalion Center)
Gulfport, Mississippi
has been granted permission to discharge wastewater into

Harrison County Wastewater Management District

in accordance with effluent limitations, monitoring requirements and other conditions set forth in this permit. This permit is issued in accordance with the provisions of the Mississippi Water Pollution Control Law (Section 49-17-1 et seq., Mississippi Code of 1972), and the regulations and standards adopted and promulgated thereunder, and under authority granted pursuant to Section 402 (b) of the Federal Water Pollution Control Act.

The issuance of this permit does not relieve the permittee from complying with any requirements which the Publicly Owned Treatment Works (POTW) Authority may deem necessary as a prerequisite to the use of the Authority's sewage system and associated treatment works.

MISSISSIPPI NATURAL RESOURCES PERMIT BOARD

Charles Chisolm

DIRECTOR, BUREAU OF POLLUTION CONTROL
MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES

Issued: October 31, 1986

Expires: October 30, 1991

Permit No. PT90249

PART I

A. PRETREATMENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning October 31, 1986 and lasting until October 30, 1991 the permittee is authorized to discharge from outfall(s) serial number(s) 001 (Treated Scrubber Effluent from Pretreatment System).

Such discharges shall be limited and monitored by the permittee as specified below:

PARAMETER	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day) Daily Avg.	kg/day (lbs/day) Daily Max.	Other Units (Specify) Daily Avg.	Other Units (Specify) Daily Max.	Measurement Frequency	Sampling Type
Flow - M^3/day (MGD)	--	--	--	(.0072)	Each Batch Discharge	Grab
2,3,7,8 Tetrachlorodibenzo-p-dioxin (TCDD)	--	--	--	Not Detectable	Three per Week	Grab
2,4,5 Trichlorophenoxyacetic Acid	--	--	--	Not Detectable	Each Batch Discharge	Grab
2,4 - Dichlorophenoxyacetic Acid	--	--	--	Not Detectable	Each Batch Discharge	Grab

2. The pH shall not be less than 5.5 standard units nor greater than 9.5 standard units and shall be monitored each batch discharge with a grab sample of the effluent.

3. All samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): in the treated effluent holding tank after neutralization and carbon filtration but prior to release to the POTW collection system.

4. Each treated batch of wastewater must be sampled and analyzed to ensure permit compliance prior to release to the POTW.

This permit may be modified after the submittal of the analytical laboratory results of the scrubber effluent from the test burns.

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B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with pretreatment limitations specified for discharge in accordance with the following schedule:

The permittee shall achieve compliance with the specified limitations upon start-up of discharge to the POTW.

2. No later than 10 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

C. GENERAL PRETREATMENT PROHIBITIONS

1. In addition to those pollutants limited in Part I.A, the following pollutants shall not be discharged into the POTW:

   (a) Pollutants which create a fire or explosion hazard in the POTW;

   (b) Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.5 unless the works is specifically designed to accommodate such discharges;

   (c) Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in interference;

   (d) Any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW; or

   (e) Heat in amounts which will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the POTW treatment plant exceeds 40 C (104° F) unless the approval Authority, upon request of the POTW, approves alternate limits.

D. ORAL NOTIFICATION REQUIREMENTS

The permittee shall notify the Mississippi Pollution Control Permit Board and the POTW orally immediately upon becoming aware of the following:

1. A spill which would result in a discharge to the POTW;

2. Any diversion or bypass of the wastewater treatment system which would result in a discharge to the POTW; or

3. Any system upset which would cause the facility to be in noncompliance with the limitations found in Part I.A or I.C of this permit.

E. OTHER SPECIFIC PRETREATMENT REQUIREMENTS

PART II

A. MANAGEMENT REQUIREMENTS AND RESPONSIBILITIES

1. No Discharge of Wastewater to Surface Water

The discharge of any wastewater from this facility to the waters of the State of Mississippi shall constitute a violation of this permit, except as provided in Section A.4 of this permit, or as authorized under separate permit pursuant to Section 402 of the Federal Water Pollution Control Act.

2. Change in Wastewater Source

Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased wastewater flows, must be reported to the Mississippi Pollution Control Permit Board. Following such notice, if the Permit Board determines that such change will violate any condition of this permit, it may require the submittal of a new application, or it may modify this permit accordingly.

3. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. Bypassing

Any diversion from or bypass of wastewater collection and treatment or control facilities is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall notify the Mississippi Pollution Control Permit Board in writing of each such diversion or bypass in advance where practicable but in any case, within 72 hours of the diversion or bypass, and shall submit to the Permit Board a plan to prevent recurrence of the diversion or bypass within thirty (30) days of the incident.

5. Removed Substances

Solids, sludges, filter backwash, or other residuals removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent such materials from entering State waters and in a manner consistent with the Mississippi Solid Waste Disposal Act and the Federal Resource Conservation and Recovery Act.

6. Power Failures

In order to maintain compliance with the conditions and prohibitions of this permit, the permittee shall either:

a. Provide an alternative power source to operate the wastewater control facilities;

or, if such alternative power source is not in existence, and no date for its implementation appears in this permit,

b. Halt, reduce, or otherwise control production and/or all wastewater flows upon reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. MONITORING, REPORTING, AND RECORD KEEPING

1. Routine Reporting

Such test results, reports, or other data as the Mississippi Pollution Control Permit Board may determine to be necessary shall be submitted on a regular basis to the following address:

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
BUREAU OF POLLUTION CONTROL
P. O. Box 10385
Jackson, Mississippi 39209

2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304 (h) of the Federal Water Pollution Control Act, as amended.

3. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored wastewater.

4. Recording of Results

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

5. Records Retention

(a) All records and information resulting from the monitoring activities required by this permit (including all records of analyses performed; calibration and maintenance of instrumentation; and recordings from continuous monitoring instrumentation) shall be retained for a minimum of three (3) years, or longer if requested by the Permit Board.

(b) The permittee shall furnish to the Permit Board, upon request, copies of records required to be kept by this permit.

6. Noncompliance Reporting

This permittee shall report any instances of noncompliance orally to the Director, or his representative, within 24 hours of becoming aware of the circumstances. A written report shall also be provided within five (5) days of such time, and shall contain the following information:

(a) A description of the noncompliance and its cause, if known.

(b) The period of noncompliance, including exact dates and times; or if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence.

7. Right of Entry

The permittee shall allow the Mississippi Pollution Control Permit Board and/or its authorized representation of credentials:

(a) To enter upon the permittee's premises where a wastewater source is located or in which records are required to be kept under the terms and conditions of this permit; and

(b) At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any wastewater generated at this facility.

8. Transfer of Ownership or Control

This permit is not transferable to any person except after proper notice. In the event of any change in control or ownership of facilities, the permittee shall notify the Mississippi Pollution Control Permit Board at least thirty (30) days in advance of the proposed transfer date. The notice should include a written agreement between the existing and new permittees containing a specific date for the transfer of permit responsibility, coverage, and liability.

9. Availability of Records

Except for data determined to be confidential under the Mississippi Air and Water Pollution Control Law, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Mississippi Bureau of Pollution Control.

10. Permit Modification

(a) The permittee shall furnish to the Permit Board within a reasonable time any relevant information which the Permit Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit, or to determine compliance with the permit.

(b) Upon sufficient cause this permit may be modified, revoked, reissued, or terminated during its term.

(c) The filing of a request by the permittee for a permit modification, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

11. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

12. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject to under Section 311 of the Federal Water Pollution Control Act or the applicable provisions under Mississippi Law pertaining to the transportation, storage, treatment, or spillage of oil or hazardous substances.

13. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

14. The structural integrity of all levees and dikes shall be maintained in good repair with a minimum freeboard of two feet from the lowest point of the levee to the surface of the water at a level that would produce a discharge of water from the containment.

15. Closure Requirements

Should the permittee decide to permanently close and abandon the premises upon which it operates, it shall so notify the Permit Board no later than 90 days prior to doing so. Accompanying this notification shall be a closure plan which describes how and when all manufactured products, by-products, raw materials, stored chemicals, and solid and liquid wastes will be removed from the premises such that they will present no potential environmental hazard to the area. Abandonment of the site without all aspects of the closure plan, will constitute a violation of this permit and may result in penalties of up to $25,000.

S-5

APPENDIX E

CORRESPONDENCE WITH EPA HEADQUARTERS ON DELISTING FOR FULL-SCALE DEMONSTRATION AT NCBC

The items contained in this appendix include various letters and submittals to the Office of Solid Waste, Headquarters EPA concerning the delistability of the incinerator ash. Additional information may be found in Reference 7. These documents were reproduced from the best available copies. Due to poor original legibility, the legibility of the microfiche editions is also poor. Persons requiring the information contained in this appendix may write to the technical libraries listed below to obtain photocopied versions of the appendix. A nominal charge will be levied to cover reproduction an archival costs. Please be prepared to provide the following information:

Report Title: Full-Scale Incineration System Demonstration Verification Test Burns at the Naval Construction Battalion Center, Gulfport, Mississippi: Treatability Tests

Report Number: ELS-TR-88-61, Volume: II, Part: 2, Appendix: E

Send inquiries to:

Technical Library
Engineering and Services Laboratory
Tyndall Air Force Base, FL 32403

or

Technical Library
Idaho National Engineering Laboratory
EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, ID 83415-2300

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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APPENDIX E

TABLE OF CONTENTS

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Appendix E, Exhibit 1

INEL
Idaho National Engineering Laboratory

January 22, 1986

Dr. Doreen Sterling
Office of Solid Waste
Waste Identification Branch
U.S. Environmental Protection Agency
401 M Street S.W. (WH-562B)
Washington, D.C. 20460

SUBMISSION OF OPTIONAL FORM: DELISTING PETITION FOR U.S. AIR FORCE TECHNOLOGY DEMONSTRATION PROJECT -JNC-01-86

Ref: Exclusion Activity Identification Number ID-0615

Dear Dr. Sterling:

Please find enclosed the following documents:

1. Optional Form for Delisting Petition for Waste Stream for the U.S. Air Force Research, Development and Demonstration (RD&D) project for incineration of dioxin-contaminated soil proposed to take place in Gulfport, Mississippi.

2. RD&D permit application submitted to EPA Region IV, Atlanta, Georgia, which is referenced in the above document.

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

We look forward to the meeting scheduled with your office on January 31, 1986, 9:00 a.m. to receive your comments/guidance and respond to any questions you may have.

Very truly yours,

J. N. Casanova
Senior Program Specialist
Hazardous Waste Program

ag

Enclosures:
As Stated

cc: (w/o Enclosures)
I. Aoki, DOE-ID
G. Harlow, EPA Region IV
Capt. T. L. Stoddart, USAF
J. O. Zane, EG&G Idaho

ATTACHMENT A

OPTIONAL FORM:

DELISTING PETITION FOR WASTE STREAM

Submitted by: EG&G Idaho, Inc.
for
U.S. Air Force

Date: January 21, 1986

SECTION A: Administrative Data and Summary

1. Name [260.20(b)(1)]

   a. Name of firm: U.S. Air Force - Engineering and Services Center

   b. Address: Tyndall Air Force Base
   Ball, Florida 32403

   c. RCRA ID Nos.: Form 8700-12 for Generator Number to be submitted to Region IV, Atlanta, GA, Jan. 29, 1986. Exclusion Activity Identification Number 0615.

2. Facility Location [260.20(b)(1)]

   a. Name: Naval Construction Battalion Center

   b. Location: Naval Construction Battalion Center
   Gulfport, Mississippi 39501

3. Names of personnel to be contacted for additional information pertaining to this petition:

Cpt. T.L. Stoddart	U.S.A.F.	(904)283-2942
H.D. Williams	EG&G Idaho (Project Manager)	(208)526-1763
J.N. Casanova	EG&G Idaho (Program Specialist)	(208)526-9736

4. Description and Justification for the Proposed Action

The proposed action is to delist an F028 waste stream (residues from the incineration of soil contaminated with an F027 hazardous waste), specifically, chlorinated dibenzo-p-dioxins and 2,4,5-trichlorophenoxyacetic acid. The waste streams for which delisting is requested include: incinerator ash (treated soil) and process wastewater from a proposed field demonstration of the Ensco Mobile Waste Processor at the Naval Construction Battalion Center in Gulfport, Mississippi.

It is predicted that these waste streams will not pose a threat to human health or the environment. The basis for this prediction is based on data being compiled through EPA from the successful delisting petition for the U.S. EPA Mobile Incineration System currently operating at Denney Farm, McDowell, Missouri. Performance data from the EPA mobile incinerator, in addition to RCRA trial burns and PCB test burns which are being conducted by Ensco should provide an adequate basis for this delisting petition.

5. Certification of Accuracy and Responsibility [260.22(i)(12)]

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signed,

(H. D. Williams on original)

Principal Program Specialist

Authorized Representative of Waste Generator, Title

SECTION B: Production Processes

1. Description of Manufacturing Processes and Other Operations [40 CFR 260.22(i)(5)].

   a. In 1980 the U.S. Air Force began a multi-phase program which will ultimately result in restoring former Herbicide Orange storage sites to beneficial use. One of the major activities is to field test, demonstrate, and evaluate selected dioxin destruction technologies to determine the feasibility of using the selected technologies for restoration activities. The process for which this petition is submitted is incineration of Herbicide Orange-contaminated soil in a multi-unit waste incineration system designed to be moved from site to site.
   A description of the major components of the system, the typical operating cycle, and inspection/maintenance schedule are provided in the enclosed RD&D permit application, Chapter 2, Process Description.

   b. Decontamination procedures for this project are provided in the enclosed RD&D permit application, Chapter 8, Closure and Equipment Decontamination Plan.

   c. A flow diagram of the operations that may provide influent into the waste stream is provided in the enclosed RD&D permit application, Chapter 2, Process Description, Figure 2-2, Schematic flow diagram of MWP-2000.

2. Materials Used or Produced

APPROACH B

Sampling and analysis requirements for the waste streams will be determined through criteria established by EPA Headquarters, Office of Solid Waste following an evaluation of the soil for Appendix VIII constituents (see Sections D and E).

Attachment A lists the Appendix VIII constituents. Each constituent has been reviewed and the following information provided whenever possible:

-NIOSH number;
-CAS number;
-if the constituent is a priority pollutant, if it is a PCDD or PCDF, if it is a component of 2,4-D or 2,4,5-T, if it is of other interest (i.e., listed by the Carcinogen Assessment Group, etc.);
-whether or not it must be further considered for presence in untreated soil;
-reason it is not likely to be present in the untreated soil (i.e., no history of being present, analytical data has shown it is not present, it is unstable and/or volatile);
-applicable comments; and
-analytical methods, applicable matrix, and detection limits.

Attachment B is a summation of those constituents which could possibly be present in the untreated soil. Laboratory analyses are currently being performed which could provide data showing certain constituents on Attachment B are not present. As soon as data is available, Attachment B will be updated to reflect only those constituents for which data is not available. Pending EPA concurrence of both Attachments A and B, evaluation of the constituents which are likely to be present in the treated soil can proceed.

SECTION C: The Waste Stream

1. EPA hazardous waste number and description of waste stream (from 40 CFR 261.31 or 261.32):

   No. F028
   Description: Residues resulting from the incineration of soil contaminated with EPA Hazardous Waste No. F027.
   Form of waste: dry solids (ash and treated soil) and aqueous solution (process wastewaters).

2. Estimated average and maximum monthly and annual quantities generated. Because this is a field demonstration project, the total operating time is anticipated to be 90 to 120 days, with the total amount of soil to be treated estimated at 9,000 yd^3. It is projected that this amount of processed soil should provide the data needed to demonstrate the reliability and maintainability of this process.

3. This waste stream will be generated in the future.

4. Present methods of on-site storage, and amounts being stored:

   This waste stream is not currently being generated.

5. Waste Management Methods:
   Briefly describe:
   (a) how the waste is currently managed;
   (b) how it was managed before November 19, 1980; and
   (c) how it will be managed if this petition is approved.

   (a) and (b) are not applicable since the waste is not currently being generated.

   (c) If the delisting petition is granted, the ash (soil) meeting the delisting criteria will be placed back on the ground on the site from which it was excavated. Process wastewaters meeting the delisting criteria will be land applied on the site where the original soil excavation occurred for use as a dust supressant.

SECTION D: Selection of Constituents for Testing

and

SECTION E: Sampling and Testing the Waste

Following identification and evaluation of the constituents which may be present in the untreated soil, and concurrence by EPA of the evaluation, those constituents can be evaluated for presence in the waste stream following treatment. Once those constituents have been identified, criteria can be established for delisting.

The delisting criteria will determine the sampling and analysis requirements for the waste stream. A sampling and an analytical contractor will be selected to perform sampling and analysis tasks. Both contractors will adhere to applicable EPA protocol. Where EPA protocol has not been established, existing laboratory protocol will be used. Statements of work, sampling plans, analysis plans, Quality Assurance/Quality Control documents, and personnel qualification statements will be provided to EPA.

Att-B2 - QW

Exclusion Activity Identification 0615

ATTACHMENT B

(Revised 2/7/86)

Attachment B
Constituer's Possibly Present in Untreated Soil

[NOTE: This list may change based on results of analyses currently being performed. This list has been modified following EPA review.]

Constituent	Analytical Methods	Detect. Limits*
Arsenic and compounds, N.O.S.		
Benzo[b]fluoranthene (2,3-Benzofluoranthene)	SW846-8250	4.800
	SW846-8310	.018
Benzo[a]pyrene (3,4-Benzopyrene)	SW846-8100	NG
	SW846-8250	2.500
	SW846-8310	.013
	8310	.023
Chlorinated benzenes, N.O.S. [EPA comment: use methods for individual benzenes]		
Chlorinated phenol, N.O.S. [EPA comment: use methods for individual phenols]		
Chromium and compounds, N.O.S.		
Chrysene (1,2-Benzphenanthrene)	SW846-8100	NG
	SW846-8250	2.500
	SW846-8310	.150
Coal tars [EPA will determine if this is necessary]		
Creosote (Creosote, wood) [EPA will determine if this is necessary]		
Dibenz[a,j]anthracene (1,2,5,6-Dibenzanthracene)		
2,4-Dichlorophenol (Phenol, 2,4-dichloro-)	SW846-8040	.390
		.630
2,6-Dichlorophenol (Phenol, 2,6-dichloro-)	SW846-8040	NG
	SW846-8250	2.7000
2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)	SW846-8150	1.000
Fluoranthene (Benzo[j,k]fluorene)	SW846-8100	NG
	SW846-8250	2.200
	SW846-8310	0.210

Hexachlorodibenzo-p-dioxins		
Hexachlorodibenzofurans		
Hydroxydimethylarsine oxide (Cacodylic acid) [EPA will determine if this is covered in the arsenics]		
Indeno (1,2,3-cd) pyrene (1,10-(1,2-phenylene) pyrene	SW846-8120 SW846-8250 SW846-8310	NG 3.700 0.043
Lead and compounds, N.O.S. [EPA comment: Use EP Tox for lead.]		
Nickel and compounds, N.O.S. [EPA comment: Use EP Tox for nickel.]		
Pentachlorodibenzo-p-dioxins		
Pentachlorodibenzofurans		
Polychlorinated biphenyl, N.O.S.	SW846-8080	ND 0.065
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)		
Tetrachlorodibenzo-p-dioxins		
Tetrachlorodibenzofurans		
2,3,4,6-Tetrachlorophenol (Phenol, 2,3,4,6-tetrachloro-)		
2,4,6-Trichlorophenol (Phenol, 2,4,6-trichloro-)	SW846-8040 SW846-8250	0.640 2.700
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid, 2,4,5-trichlorophenoxy-)	SW846-8150	0.100

*Detection limits are for liquids. Solids detection limits may be considerably higher.

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Appendix E, Exhibit 2

bcc: T. H. Smith
D. L. Uhl
H. D. Williams
Central Files
J. N. Casanova File
Hazardous Waste Projects

INEL
Idaho National Engineering Laboratory

June 10, 1986

Dr. Doreen Sterling
Office of Solid Waste
Waste Identification Branch
U.S. Environmental Protection Agency
401 M Street S.W. (WH-562B)
Washington, DC 20460

REQUEST FOR VERIFICATION OF ADEQUACY OF APPENDIX A, RD&D PERMIT APPLICATION TO REGION IV, EPA -JNC-26-86

Dear Dr. Sterling:

The May 9, 1986 revision of the RD&D Permit Application to EPA Region IV for the U.S. Air Force Technology Demonstration planned for Gulfport, Mississippi was recently transmitted to your office. In that permit application, Appendix A was called to your attention as the Sampling and Analysis Matrix we are planning to use during this project. To the best of our knowledge, we have attempted to incorporate all constituents which we understand to be of concern for the purpose of delisting.

Because the RD&D permitting process is proceeding very expeditiously, we are seeking verification from your office that the Sampling and Analysis Matrix, as presented in the RD&D Permit Application, is acceptable for the purpose of pursuing delisting. If we have overlooked any constituents or characteristics which you believe should be included, please notify us as soon as possible such that the draft permit and application can be revised to incorporate your concerns.

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

An additional copy of the Sampling and Analysis Matrix is enclosed for your convenience. We would greatly appreciate a response from your office as soon as possible.

Very truly yours,

J. N. Casanova
Senior Program Specialist
Hazardous Waste Projects

ag

Enclosures:
As Stated

cc: (w/o Enclosures)
I. Aoki, DOE-ID
Capt. T. L. Stoddart, USAF
J. O. Zane, EG&G Idaho

APPENDIX A
SAMPLING AND ANALYSIS MATRIX

APPENDIX A
SAMPLING AND ANALYSIS MATRIX

Table A-1 presents the Criteria List that will determine the sampling and analysis requirements for this RD&D project. Individual constituents were identified through evaluation of existing data of NCBC soil and comparison with the Appendix VIII constituents in 40 CFR Part 261. EPA Headquarters has reviewed and commented on the constituents.

The goal of this demonstration is to reduce the TCDD concentrations in the soil at the HO site to $\leq$1 ppb and the total chlorinated dibenzodioxins and dibenzofurans to <1 ppb. Therefore, the treated soil and excavated holes will be sampled and analyzed throughout the demonstration to meet these goals.

In addition, a test run will be conducted before full operation to allow sampling and analysis of the treated soil to ensure that the remaining criteria in Table A-1 are met.

A requirement for issuance of the sampling and analysis subcontracts is that EPA sampling protocol and analytical methods be adhered to. Additional details of sampling and analysis will be available following award of subcontracts.

DELISTING PLAN

Final disposition of the treated soil will be determined through the delisting petition process through EPA Headquarters, Office of Solid Waste, Waste Identification Branch. Delisting efforts were formally initiated in October 1985. Petition identification number 0615 has been assigned to delisting activities for this project.

TABLE A-1. SAMPLING AND ANALYSIS MATRIX

Constituent	Analytical Method	Criteria/ Detection Limit[a]
Criteria List		
Parameters for Routine Sampling		
Total chlorinated dibenzo-dioxins and dibenzofurans (CDDs and CDFs)	8280	<1 ppb
2,3,7,8-TCDD	8280	≤1 ppb
Parameters for Test Run		
Metals		
Antimony	SW846-7040	1 ppm
Arsenic	EP Toxicity	5 ppm
Barium	EP Toxicity	100 ppm
Beryllium	SW846-7090	1 ppm
Cadmium	EP Toxicity	1 ppm
Chromium	EP Toxicity	5 ppm
Copper	SW846-7210	1 ppm
Lead	EP Toxicity	5 ppm
Mercury	EP Toxicity	0.2 ppm
Nickel	SW846-7520	1 ppm
Selenium	EP Toxicity	1 ppm
Silver	EP Toxicity	5 ppm
Thallium	SW846-7840	1 ppm
Zinc	SW846-7950	1 ppm
Appendix VIII Constituents		
Benzo[b]fluoranthene	SW846-8250	4.800 ppb
(2,3-Benzofluoranthene)	SW846-8310	0.018 ppb
Benzo[a]pyrene (3,4-Benzopyrene)	SW846-8100	NG[b]
	SW846-8250	2.500 ppb
	SW846-8310	0.013 ppb
	8310	0.013 ppb
Chlorinated benzenes [EPA comment: use methods for individual benzenes][c]		
Chlorinated phenol [EPA comment: use methods for individual phenols][c]		

Constituent	Analytical Method	Criteria/ Detection Limit[a]
Chrysene (1,2-Benzphenanthrene)	SW846-8100 SW846-8250 SW846-8310	NG[b] 2.500 ppb 0.150 ppb
Coal tars [EPA will determine if this is necessary][c]		
Creosote (Creosote, wood) [EPA will determine if this is necessary][c]		
Dibenz[a,h]anthracene (1,2,5,6-Dibenzanthracene		
2,4-Dichlorophenol (Phenol, 2,4-dichloro-)	SW846-8040	0.390 ppb 0.630 ppb
2,6-Dichlorophenol (Phenol, 2,5-dichloro-)	SW846-8040 SW846-8250	NG[b] 2.700 ppb

a. Detection limits are for liquids. Solids detection limits may be considerably higher.

b. NG = not given.

c. Guidance from EPA Headquarters, Office of Solid Waste, Waste Identification Branch.

d. ND = not determined.

Appendix E, Exhibit 3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 11 1986

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

Ms. J.N. Casanova
Senior Program Specialist
Idaho National Engineering Laboratory
P.O. Box 1625
Idaho Falls, ID 83415

Re: Adequacy of Sampling Matrix for NCBC Permit Application

Dear Ms. Casanova:

In response to your letter of June 10, 1986 requesting verification of the adequacy of the Sampling and Analysis matrix for the U.S. Air Force Technology Demonstration for the Gulfport, MS facility, we have reviewed the submitted matrix. In order to evaluate the combustion efficiency of the ENSCO incinerator, we believe the following polycyclic aromatic hydrocarbons (PAHs) should be included in the Sampling and Analysis matrix:

Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(a)pyrene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Indeno(1,2,3-cd)pyrene

The analysis for total chlorinated dibenzodioxins and dibenzofurans should include analyses for the tetra-, penta-, and hexachlorinated isomers. The analyses for chlorinated benzenes and phenols should include:

1,2,4,5-Tetrachlorobenzene
1,2,3,5-Tetrachlorobenzene
2,4-Dichlorophenol
2,6-Dichlorophenol
2,5-Dichlorophenol
3,4-Dichlorophenol
2,3,4-Trichlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,3,4,5-Tetrachlorophenol
2,3,4,6-Tetrachlorophenol

In addition, analyses should be conducted for phenol, nitrosoamines, and the pesticides 2,4-D and 2,4,5-T. Table 1 summarizes the list of constituents we believe are necessary to characterize the treated wastes.

If you have any questions or need further clarification, please do not hesitate to call me at (202) 382-4782.

Sincerely,

Myles E. Morse

Myles Morse
Acting Section Chief
Variances (Delisting) Section
Office of Solid Waste

Table 1

Recommended Sampling and Analysis Matrix

Constituent	Analytical Method	Detection Limit
Total chlorinated dibenzodioxins and dibenzofurans	8280	
TCDDs		
PeCDDs		
HxCDDs		
TCDFs		
PeCDFs		
HxCDFs		
2,3,7,8-TCDD	8280	
Metals	Total and EP Toxicity	(6.3 x Drinking Water Standards
Arsenic		
Barium		
Cadmium		
Chromium		
Lead		
Mercury		
Nickel		
Selenium		
Silver		
Organic Constituents		
Phenol		10 ppm
Chlorinated Benzenes		
1,2,4,5-Tetrachlorobenzene		50 ppb
1,2,3,5-Tetrachlorobenzene		50 ppb
Chlorinated Phenols		
2,4-Dichlorophenol		10 ppb
2,6-Dichlorophenol		10 ppb
2,5-Dichlorophenol		10 ppb
3,4-Dichlorophenol		10 ppb
2,3,4-Trichlorophenol		50 ppb
2,4,5-Trichlorophenol		50 ppb
2,4,6-Trichlorophenol		10 ppb
2,3,4,5-Tetrachlorophenol		50 ppb
2,3,4,6-Tetrachlorophenol		50 ppb

Constituent	Analytical Method	Detection Limit
Pesticides		
2,4-D		1.0 ppb
2,4,5-T		0.1 ppb
Polycyclic Aromatic Hydrocarbons		
Benzo(a)anthracene		10 ppb
Benzo(b)fluoranthene	SW846-8250,8310	10 ppb
Benzo(a)pyrene	SW846-8100,8250,8310	10 ppb
Chrysene	SW846-8100,8250,8310	10 ppb
Dibenzo(a,h)anthracene		10 ppb
Fluoranthene		10 ppb
Indeno(1,2,3-cd)pyrene		10 ppb

DRAFT

Versar INC.

October 15, 1986

Mr. Myles Morse
Action Section Chief
U.S. Environmental Protection Agency
Variances (Delisting) Section
Office of Solid Waste, USEPA
401 M Street S.W. WH562B
Washington, D.C. 20460

Reference: United States Air Force Delisting Petition No. ID-0615

Dear Mr. Morse:

Thank you for the opportunity to meet on September 19, 1986, to discuss the status of the United States Air Force's petition to delist treated soil at the NCBC site in Gulfport, Mississippi. As Gwen Depoix (SAIC) has informed you, I have prepared this letter for the following two purposes:

1. To inform EPA/OSW of the Air Force's proposed sampling and analysis plan for the upcoming ENSCO incinerator test burn at NCBC. This plan incorporates EPA/OSW's recommendations as per your September 11, 1986, letter, and

2. To propose a schedule which identifies the milestones on the soil delisting path from the test burn, and more importantly, identifies what feedback is needed from EPA/OSW by the Air Force in order to petition delisting of the soil from the RD&D effort following the test burn.

ENSCO Test Burn Sampling and Analysis Plan

For reference, Attachment 1 is a copy of EPA/OSW's September 11, 1986 recommended sampling and analysis matrix. Using these recommendations as a baseline, and additional recommendations made by an EG&G analytical chemist (see Attachment 2), EG&G has prepared a statement of work for the chemical analysis of verification samples which will be collected during the ENSCO test burn at NCBC (see Attachment 3). In short, EG&G will perform all analyses as requested by EPA/OSW and several additional analyses to ensure that any data requested after the test is available. A comparison between Attachments 1 and 3 will reveal the additional tests to be performed, however, the following additions are worth noting:

- TCDDs and TCDFs - Method 8280 was specified for analysis of TCDDs and TCDFs. Because this is a low resolution method, EG&G will also run analyses using a modified method 8280 which is amenable to high resolution MS analysis. Besides using method 8280 for 2,3,7,8-TCDD analysis, analyses will also be performed using the method specified under the Contract Laboratory Program (CLP). In all cases, the TCDD and TCDF analyses will be performed using the most sensitive equipment available.

6850 VERSAR CENTER • P.O. BOX 1549 • SPRINGFIELD, VIRGINIA 22151 • TELEPHONE: (703) 750-3000 • TELEX: 901125

Versar INC.

- Organics - Three analytical methods can be used to perform analyses for organics; 8010, 8020, and 8120. Because the treated soil may require multiple analyses to obtain the required detection limits, analyses will be performed using all three methods. We believe the current sampling and analysis plan is more than adequate and request EPA/OSW review plan for the upcoming test burn which will lead to the successful delisting of the treated soil. If EPA/OSW concurs, then we request that EPA/OSW approve the present plan for use on the upcoming test burn.

Proposed Delisting Schedule

Figure 1 is a milestone chart which summarizes the events that will lead to the decision for delisting of the treated NCBC soil. As this schedule shows, two key issues need to be addressed by EPA/OSW for successful RD&D activity at the site to be performed. They are as follows:

1. EPA/OSW approval of the sampling and analysis test plan prior to the ENSCO test burn presently scheduled for the week of November 17, 1986.

2. The Air Force plans to present results of the test burn and a test plan for the RD&D activity at the NCBC site to EPA/OSW on January 15, 1987. A petition for the delisting of the soil from the test burn in November 1986 will be formally submitted to EPA. Based on the review of the test burn results, and the proposed plan for the RD&D activity, the Air Force will solicit EPA/OSW feedback on the adequacy of information from a delisting standpoint. This feedback is needed by January 26, 1986, and can be in the form of a meeting at EPA/OSW, a teleconference or a letter. The Air Force understands that this feedback in no way obligates EPA/OSW, however, it is necessary before large amounts of resources are dedicated to the total RD&D activity.

If you should have any questions concerning this schedule or the sampling and analysis plan, please contact me or Harry Williams (EG&G) at (601) 864-4139.

Thank you.

Sincerely,

Carrell B. Derrington, Jr. P.E.

DBD/sh
Attachments

Versar INC.

Action Items for This Letter

1. The Air Force requests that EPA/OSW provide approval of the present sampling and analysis plan.

2. The Air Force requests EPA/OSW's comments on the adequacy of the proposed schedule in light of delisting NCBC treated soil.

Table 1

Recommended Sampling and Analysis Matrix

Constituent	Analytical Method	Detection Limit
Total chlorinated dibenzodioxins and dibenzofurans	8280	
TCDDs		
PeCDDs		
HxCDDs		
TCDFs		
PeCDFs		
HxCDFs		
2,3,7,8-TCDD	8280	
Metals	Total and EP Toxicity (6.3 x Drinking Water Standards	
Arsenic		
Barium		
Cadmium		
Chromium		
Lead		
Mercury		
Nickel		
Selenium		
Silver		
Organic Constituents		
Phenol		10 ppm
Chlorinated Benzenes		
1,2,4,5-Tetrachlorobenzene		50 ppb
1,2,3,5-Tetrachlorobenzene		50 ppb
Chlorinated Phenols		
2,4-Dichlorophenol		10 ppb
2,6-Dichlorophenol		10 ppb
2,5-Dichlorophenol		10 ppb
3,4-Dichlorophenol		10 ppb
2,3,4-Trichlorophenol		50 ppb
2,4,5-Trichlorophenol		50 ppb
2,4,6-Trichlorophenol		10 ppb
2,3,4,5-Tetrachlorophenol		50 ppb
2,3,4,6-Tetrachlorophenol		50 ppb

Constituent	Analytical Method	Detection Limit
Pesticides		
2,4-D		1.0 ppb
2,4,5-T		0.1 ppb
Polycyclic Aromatic Hydrocarbons		
Benzo(a)anthracene		10 ppb
Benzo(b)fluoranthene	SW846-8250,8310	10 ppb
Benzo(a)pyrene	SW846-8100,8250,8310	10 ppb
Chrysene	SW846-8100,8250,8310	10 ppb
Dibenzo(a,h)anthracene		10 ppb
Fluoranthene		10 ppb
Indeno(1,2,3-cd)pyrene		10 ppb

ATTACHMENT II

Comments on Table 1

TO: Harry Williams

FROM: Dave Miller

DATE: October 2, 1986

Total chlorinated dibenzodioxins and dibenzofurans

Analytical methodology - 8280

8280 is low resolution MS Method. To achieve lowest possible detection limits will EPA accept a modified 8280 amenable to high resolution MS analysis or will they accept a high resolution Method for review that is laboratory specific

Detection limits for various congener classes were not specified in letter. Does this mean that EPA does not care or that they wish to follow detection limits demonstrated in 8280. Examples are given in Table 8 of the Draft 8280 for various matrices. As can be seen, the limits vary with matrix and congener classes. These limits are also for ^{13}C species which usually have lower background levels at the monitored masses and thus lower detection limits.

As for 2,3,7,8-TCDD analysis it would be simpler to use the CLP method or equivalent.

Organic Constituents

Phenol - Response letter suggests no analytical method but a detection limit of 10 ppb. Is this a required detection limit? EPA method SW846-8040 states an achievable D.L. of 0.14 μ/l for wastewaters by GC FID. We will be dealing with dirty soil.

Chlorinated Phenols - Method 8040 could be used for this analysis. However, EPA lists specific chlorinated phenols in its letter. 8040 provides insufficient information about possible peak overlaps which would preclude the requested specificity. Will EPA accept alternative methods?

Chlorinated Benzenes - No method specified - May use 8010, 8020, 8120. Detection limits are questionable. May require multiple analyses.

Pesticides - Want 2,3-D and 2,4,5-T analyzed. Use method 8150? Detection limits are for wastewater. May need to be adjusted for solids, particularly the 2,4,5-T D.L. of 0.1 ppb. This is unrealistic for soils.

PAH — All PHSa specified are included in PPL BASE/NEUTRAL EXTRACTABLES. Rather then use 8250 as given 8270 should be used. Detection limits may be questionable based on sample matrix involved. Alternative method is 8100. As last resort 8310 (liquid chromotography)

General Comments

- Table 1 does not include nitrosoamines. This represents a difference between the letter and the Table.
- How were D.L. arrived at and what is really required?
- Does Table 1 represent all compounds of interest?

ATTACHMENT III

STATEMENT OF WORK

FOR CHEMICAL ANALYSIS OF VERIFICATION

SAMPLES FROM SOIL INCERATION

1.0 OBJECTIVE

The objective of this work is:

Analysis: The contractor shall analyze samples of soil, gas, and water involved with the incineration of 2,3,7,8-tetrachloro-dibenzo-para-dioxin (TCDD) contaminated soil. The samples will involve treated/untreated soil, stack gas, scrubber water, and boiler blowdown water. The analysis involved are presented in Attachment A. The compounds listed are under EPA review but assessment is that changes to the list will be minimal.

2.0 BACKGROUND

From approximately 1965 to 1977, containers of Herbicide Orange were stored on an open-air site at the Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. During this time some of the herbicide leaked on the ground leaving TCDD, 2,4-D, & 2,4,5-T as contaminants in the soil. The soil is cement stabilized sandy loam, established in the 1940's. Over the years, small amounts of asphalt, road tar, and road mix have been placed on the site. These placements are spotty (less than 10% surface area), however, the asphalt will perturb analysis. EG&G will supply necessary protocol modifications for this problem. Some oystar shell and pea gravel is also present.

High volume air samples will be taken during the course of the incineration program to determine if the operation is releasing dioxin contaminated particulates into the air.

3.0 REQUIREMENTS

3.1 Analytical Procedures

The contractor shall perform analyses for all procedures listed in Attachment A. For dioxin/furan analysis the contractor shall utilize SW846-8290 and the U.S. EPA Contract Laboratory Program (CLP) IFB dioxin procedure to the extent possible. It is anticipated that modifications to the CLP procedure will be necessary, primarily in the extraction portion of the procedure. It is also anticipated that the concentrations of the spiking solutions and calibration solutions specified in the CLP procedure may have to be modified to more accurately reflect the analytical concentration range of interest. All quality assurance/quality control (QA/QC) measures specified in SW846 or the CLP procedure will be adhered to for all all analyses. Modifications to the procedures made to perform the requested analyses will be submitted to EG&G for comment and/or approval prior to implementation.

3.2 Sample Types

The following samples types will be submitted to the contractor for analysis. These samples will be obtained by a separate contract.

3.2.1 Soil Samples The contractor shall determine the amount of Att. A. compounds (if any) present in soil samples obtained by the field sampling team. These soil samples will consist of composite aliquots from soil handling equipment using EPA sampling protocol. The contractor will receive a minimum or ten (10) samples and a maximum of twenty (20) samples which will be treated and untreated. A detection limit of 0.01 ppb dioxin is required. It should be noted that a number of the untreated soil samples may contain small quantities of asphalt, which may necessitate extra cleanup. Also, these analyses will require high resolution GC and MS equipment for the CLP/IFB procedure. Method SW846-8290 is to also be performed.

3.2.2 Aqueous Samples The contractor shall determine the amount of Att. A compounds present (if any) in aqueous samples obtained by the field sampling team. Each sample will consist of a minimum of two (2) liters. The contractor will receive a minimum of ten (10) and a maximum of twenty (20) filtrate samples. A detection limit of ten (10) parts-per-trillion is required for dioxins/furans, or as stated in Att. A. In addition, pH is to be determined to the nearest tenth and TOC, BOD, COD, dissolved solids, and ammonia are to be determined.

3.2.3 High Volume Air Samples The contractor shall determine the amount of dioxin/furan present (if any) in particulate acquired on filters collected using high volume air samples. The contractor will receive a minimum of five (5) and a maximum of ten (10) samples. A detection limit of 0.1 nanograms per filter is required. It is anticipated that soxhlet extraction using toluene or benzene will be required for the filters. Other compounds in Att. A are to also be determined.

3.2.4 Stack Gas Samples The contractor shall provide analysis of Att. A compounds in stack gas samples collected by the field sampling team. Samples will consist of standard MM5/VOST/XAD and the contractor can expect five (5) sample trains.

3.3 Analytical Standards

The contractor will supply all necessary analytical standards for this program. For dioxins, these standards include $^{13}C_{12}$ - 2,3,7,8-TCDD, $^{37}Cl_4$ - 2,3,7,8-TCDD, 2,3,7,8-TCDD, and the performance check solution used to demonstrate the isomer specificity of the gas chromotography column. All standards may be obtained from commercial sources. All standards will be verified for concentration using U.S. EPA and National Bureau of Standards reference standards. The results of the verification will be provided to EG&G Idaho, Inc.

3.3 Turnaround Time

Samples will be delivered to the contractor either by overnight express service or by EG&G personnel or their designates. It will be necessary to have rapid turnaround of analytical results. The samples will arrive over approximately seven days. In addition to meeting protocol requirements, the contractor will provide EG&G immediate results and a final report within 30 days of receiving the last sample.

3.4 EG&G Representation in Laboratory

Due to the rapid turnaround time required, the contractor will be required to allow an EG&G representative to validate data in the contractors laboratory. The data validation procedure will not interfere with the analysis of the samples.

3.5 Disposal of Samples

Upon direction from EG&G and following submission of the final report, it will be the contractor's responsibility to dispose of any unused portions of samples. The disposal must conform to the appropriate government regulations.

3.6 Public Relations

The contractor shall ensure that all contracts with the news media about this work are made through the Headquarters AFESC Public Affairs (PA) Officer, Major J. Heaberg or Master Sergeant J. Denney, phone number (904) 283-6476, Tyndall Air Force Base, Florida. No information shall be released without prior clearance from AFESC/PA and NCBC Public Information Officer.

4.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

The contractor shall submit a Quality Assurance/Quality Control Plan which covers all the activities of this Statement of Work. The procedures to be followed for the chain of custody of all samples shall be clearly presented. The procedures in this QA/QC Plan, once approved by EG&G, Idaho, shall be followed in the execution of this work.

5.0 DELIVERABLES

5.1 Final Report

The contractor shall provide to EG&G a final report summarizing the results of all the analyses including QA/QC samples. This final report will follow the CLP reporting format and shall include the CLP required deliverable. The final report will be due 30 days after receiving the last sample.

5.2 Interim Reports

The contractor will not be required to prepare interim reports; however, as data is available it is to be presented to the EG&G representative, who will provide daily reports via PC.

5.3 Laboratory Notebooks

The contractor shall include, as an appendix to the final report, copies of the laboratory notebook pages pertaining to all aspects of this program.

5.4 Presentation of Results

The contractor will be present for presentation and discussion of the results to the U.S. Air Force, State officials, EPA Regional officials, and EPA-HQ.

ATTACHMENT A

Constituent	Analytical Methods[a]	Detect. Limits[b] (ug/Kg)
Arsenic	___c	___c
Barium	___c	___c
Benzidine ([1,1'-Biphenyl]-4,4' diamine)	SW846-8250	44.000
Benzo[a]anthracene (1,2 Benzanthracene)	SW846-8250	7.800
Benzo[b]fluoranthene (2,3-Benzofluoranthene)	SW846-8250	4.800
Benzo[a]pyrene (3,4-Benzopyrene)	SW846-8310	0.018
	SW846-8100	___d
	SW846-8250	2.500
	SW846-8310	0.013
	-8310	0.023
Bis(2-chloroetnoxy)methane (Ethane,[methylenebis (oxy)]bis[2-chloro-])	SW846-8010	___d
Bis(2-chloroisopropyl) ether (Propane, 2,2'-oxybis[2-chloro-])	___e	___d
Cadmium	___c	___c
Chlorinated benzenes, N.O.S.	___e	___d
1,2,4,5-Tetrachlorobenzene	___e	___d
1,2,3,5-Tetrachlorobenzene	___e	___d
Chlorinated phenol, N.O.S.	___e	___d
2.4-Dichlorophenol	SW846-8040	0.390
2.6-Dichlorophenol	SW846-8040	0.630
	SW846-8250	___d
2,5-Dichlorophenol	___e	2.700
3,4-Dichlorophenol	___e	___d
2,3,4-Trichlorophenol	___e	___d
2,4,5-trichlorophenol	___e	___d
2,4,6-Trichlorophenol	SW846-8040	___d
	SW846-8250	0.640
2,3,4,5-Tetrachlorophenol	___e	2.700
2,3,4,6-Tetrachlorophenol	___e	___d

Chromium	___c	___c
Chrysene (1,2-Benzphenanthrene)	SW846-8100	___d
	SW846-8250	2.500
	SW846-8310	0.150
Coal tars	___e	___d
Creosote (Creosote, wood)	___e	___d
Cresols (Cresylic acid) (Phenol, methyl-)	SW846-8040	___d
Dibenz[a,h]anthracene (1,2,5,6-Dibenzanthracene)	___e	___d
3,3'-Dichlorobenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-)	SW846-8250	16.500
2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)	SW846=8150	1.000
4.6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)	___e	___d
2,4-Dinitrophenol (Phenol, 2,4-dinitro)	SW846-8040	13.000
		___d
	SW846-8250	42.000
2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)	SW846-8090	.060
	SW846-8250	5.700
2,6-Dinitrotoluene (Benzene, 1-methyl-2-6-dinitro-)	SW846-8090	.060
	SW846-8250	1.600
Fluoranthene (Benzo[j,k]fluorene)	SW846-8100	___d
	SW846-8250	2.200
	SW846-8310	0.210
Hexachlorodibenzo-p-dioxins	SW846-8280	___d
	___e	___d
Hexachlorodibenzofurans	SW846-8280	___d
	___e	___d
Hydroxydimethylarsine oxide (Cacodylic acid)	___e	___d
Indeno (1,2,3-cd) pyrene (1,10-1,2-phenylene) pyrene	SW846-8120	___d
	SW846-8250	3.700
	SW846-8310	0.043

Lead	___c	___c
Mercury	___c	___c
Nickel	___c	___c
4-Nitrophenol (Phenol, 4-nitro-)	SW846-8040	2.800 .700
	SW846-8250	2.400
N-Nitrosodimethylamine (Dimethylnitrosamine)	SW846-8250	___d
Pentachlorodibenzo-p-dioxins	SW846-8290	___d
	___e	___d
Pentachlorodibenzofurans	SW846-8290	___d
	___e	___d
Phenol (Benzene, hydroxy)	SW846-8040	0.140 2.200
	SW846-8250	1.500
Polychlorinated biphenyl, N.O.S.	SW846-8040	___d 0.065
Selenium	___c	___c
Silver	___c	___c
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)	SW846-8290	___d
	___e	___d
Tetrachlorodibenzo-p-dioxins	SW846-8290	___d
	___e	___d
Tetrachlorodibenzofurans	SW846-8290	___d
	___e	___d
Toxaphene (Camphene, octachloro-)	SW846-8250	___d
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid, 2,4,5-trichlorophenoxy-)	SW846-8150	0.100

a. Where analytical protocols are specified they are EPA-SW-846

b. Detection levels given are ug/Kg in water per SW-846. Soil values may be higher but must be the lowest possible, utilizing the most sensitive equipment available.

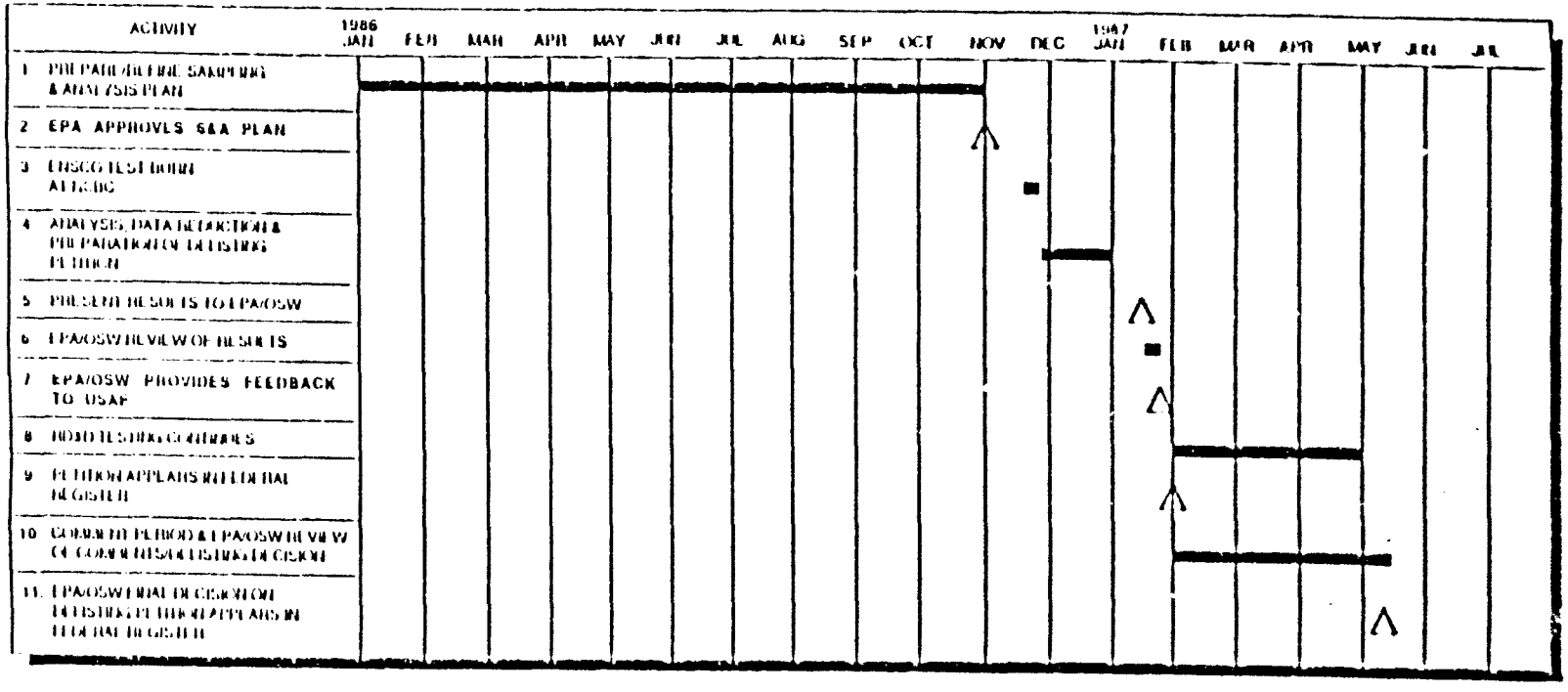
c. For metal analysis the protocol utilized must produce the lowest detection limits possible and results should indicate amount present. In addition EP Toxicity (6.3 x Drinking water standards) should be reported.

d. No detection limit specified. Detection level must be the lowest possible, using the most sensitive equipment available.

e. No protocol specified. Protocol used must produce the lowest detection level possible and be recognized as the CLP or industry standard. Protocols used must be approved by EG&G, Idaho, Chemical Sciences Branch.

Figure 1

MILESTONE CHART
DELISTING OF TREATED NCBC SOIL



OCTOBER 15, 1986

Appendix E, Exhibit 5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 12 [illegible]

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

Mr. Darrell Derrington
Versar
6850 Versar Center
P.O. Box 1549
Springfield, VA 22151

Reference: United States Air Force Delisting Petition #0615

Dear Darrell:

The Agency has reviewed the Air Force's proposed sampling and analysis plan for the upcoming ENSCO incinerator test burn at NCBC as well as the proposed delisting schedule. In response to your request of Agency approval of both items, we urge you to obtain the "Petitions to Delist Hazardous Wastes: A Guidance Manual", available from NTIS (PB85-194488). This guidance should provide you with additional information on data submittal requirements for delisting petitions, including number of samples, sampling methods, QA/QC requirements, required documentation and suggested formats, etc.

In regard to the list of analyses provided in Attachment A, the Agency concurs that with the possible exception of cyanide and sulfide testing, it appears to be complete and should be adequate for the purpose of a delisting evaluation. The Agency reminds you, however, that you must demonstrate that the petitioned waste does not demonstrate the characteristics of corrosivity, ignitability, and reactivity (i.e., provide pH, flashpoint, and cyanide/sulfide results, or a statement explaining why the waste does not exhibit these characteristics). Cyanide results are required for VHS evaluation. Thus, provide Total Cyanide (SW846-9010) and EP results for cyanide using a distilled water extractant.

The required detection limits in the case of dioxin is dependent upon the level of regulatory concern at which the Agency will delist a waste. The NCBC incineration residue will be identified as EPA Hazardous Waste No. F028, which is a toxic waste rather than an acute hazardous waste. While

the Agency has suggested levels of concern for the downgrading of acutely hazardous wastes to toxic wastes in various proposals, none have been finalized to date. Further, the Agency has not promulgated a regulatory standard for dioxin which is applicable to delisting evaluations. Thus, it is not possible at this time for the Agency to provide you with a final target level for delisting. The Agency is considering using various exposure route scenarios, such as overland sediment and soil transport, and groundwater transport, in the evaluation of dioxin-related petitions. If the Agency determines that the waste is to be evaluated using the Organic Leachate Model (see 51 FR 41082-41100, November 13, 1986) and the VHS Model (see 50 FR 48886, Appendix, November 27, 1985) with a regulatory standard of 0.2 ppq, a solubility of 0.2 ppb, and a waste volume of 9,000 yd^3, the maximum acceptable level for delisting of dioxin in the incinerator residue would be 0.07 ppt. The Agency may, however, determine that other exposure route scenarios are more relevant for dioxin wastes. These scenarios may result in a less conservative level of concern. The Agency recognizes that the levels set by back-calculating through exposure scenarios may result in levels of concern below the available detection limits for a solid matrix. We therefore stress the importance of achieving the lowest possible detection limits. The waste will also be evaluated for other constituents of concern and must pass the OLM/VHS analysis before a delisting can be granted.

While you will be required to conduct a TCLP analysis of the residue for dioxin in conjunction with the land disposal restriction regulation (see 51 FR 40615, November 7, 1986) a dioxin leachate level below the treatment standard will not demonstrate that the waste is nonhazardous for delisting purposes. The waste will still be subject to the OLM/VHS analysis.

With respect to your suggested delisting schedule, the Agency agrees to meet on January 16, 1987, in order for you to present the test burn results, test plan, and formal delisting petition. We are skeptical, however, about being able to provide you with adequate feedback regarding the petition within 10 days of that meeting. We will make a reasonable effort to review this data as soon as possible, however, the complexity of the review associated with a dioxin-related petition generally requires a longer review period. It should also be noted that petitions are reviewed on an "as submitted" basis, therefore it may take the Agency longer to respond depending on petition workload at that time.

In addition, your milestone chart (10/15/86) shows publication of a proposed decision at the beginning of February 1987; this milestone is definitely not reasonable. In addition to the Agency's review of the formal petition (and assuming

the petition is complete and requests for additional information are not made), a Federal Register notice proposal must be drafted, reviewed within the Delisting Program, submitted to Work Group review and Work Group comments must be addressed prior to publication in the Federal Register. While the Agency recognizes the petitioner's time requirements and will work to move the petition through the system efficiently, the review, proposal and finalization process generally takes six months after submission of a complete petition.

Please contact me if you have any further questions.

Sincerely,

Myles E. Morse

Myles Morse
Acting Chief
Variances Section

cc: Alpha Bell, Region IV
Alan Antley, Region IV
Gwen Dupois, SAIC

Exhibit 1

EG&G Idaho

INTEROFFICE CORRESPONDENCE

Date: July 9, 1986

To: H. D. Williams

From: M. Saint Louis MSL

Subject: EPA APPROACH TO EVALUATE DELISTING PETITIONS -MSL-04-86

In response to your request concerning the status of a delisting petition made by EG&G on behalf of DOD for dioxin, attached is the quantitative results of this preliminary effort.

EPA proposes to use an analytical approach to evaluate the potential hazard of disposed wastes. The approach involves the use of a groundwater transport model, the vertical horizontal spread (VHS) model, which assumes a reasonable worst-case condition, to model the transport of toxicants from disposal sites to nearby receptors.

With the exception of the contaminant concentration in the leachate and the volume of the waste being disposed, all of the values for the models parameters are fixed. For our purposes a treatment residue containing 2,3,7,8-TCDD of less than 0.1 ppb concentrate was used. Solution of the model at a compliance point of 500 ft provides a theoretical concentration of 3.38×10^{-5} ppq.

The concentration of 2,3,7,8-TCDD at the compliance point is below drinking water standards. Therefore, by using 2,3,7,8-TCDD as the controlling constituent, the result of the VHS model proves that the waste residues, after treatment, can be quantitatively delisted.

ag

cc: K. D. Davis 639
M. Saint Louis File
Hazaradous Waste Program

OBJECTIVE

The purpose of this delisting study is to show that residues obtained from the thermal treatment of the hazardous waste at the Naval Construction Battalion Center (NCBC) contaminated area can be excluded from the listed waste, as described in 40 CFR 261.31 and 261.32. This preliminary study applied a quantitative approach used by the Environmental Protection Agency (EPA) for evaluating delisting petitions. In addition, this information will provide some regulatory basis for supporting a Mobile Incineration System (MIS) for treating the hazardous wastes indentified at NCBC.

BACKGROUND

EPA has developed an analytical approach to determine whether a delisting petition submitted by EG&G Idaho, Inc. on behalf of the Department of Defense (DOD), can be approved. The approach involves the use of a groundwater transport model, the vertical and horizontal spread (VHS) model and assumes reasonable worst-case conditions to transport of toxicant from disposal sites to nearby receptors. More specifically the model estimates the ability of an aquifer to dilute the toxicants from a specific volume of waste and predict toxicant levels at a receptor well. The predicted levels of toxicants are then compared to health-based standards for these compounds, in an effort to evaluate hazard potential. (See 50 FR 7896-7900 for a complete description of the proposed model.) The basic approach is outlined in the following pages.

EPA proposed to use this approach as one factor to determine the potential impact of unregulated disposal of delisted waste on health and the environment. EPA recognizes that qualitative judgement always will play an important role in evaluating delisting petitions.

BACKGROUND ON WASTE

The U.S. Air Force (USAF) is engaged in a multi-task program to investiage three DOD sites known to be contaminated with residual Herbicide Orange (HO), and to identify, evaluate, and demonstrate technologies that could be used

to decontaminate and restore these sites. One of these compounds has been determined to be 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), a highly toxic and stable compound.

Incineration has been demonstrated to be effective in destroying HO and 2,3,7,8-TCDD. Since 2,3,7,8-TCDD is the subject of much scientific and regulatory attention today, it will be used in demonstrating this VHS model.

CALCULATIONS

VHS Model:

The model mathematically simulates the migration of toxicant-bearing leachate from the waste into an underlying aquifer and subsequent dilution of the toxicant due to dispersion within the aquifer.

This approach considers a number of factors, including:

- The toxicity of the constituents of the waste;
- The concentration of the constituents in the waste;
- The mobility of the toxicants in the waste;
- The persistence of the specific toxicants;
- The plausible types of improper management of the waste; and
- The quantity of waste generated.

This approach, which makes reasonable worst-case assumptions, will be used to predict the level of the various toxicants which could migrate to environmental receptors.

VHS Model is used by EPA to predict the maximum concentration of the diluted toxicants at a compliance point located 500 ft from the disposal site.

VHS Equation:

Equation (1) expresses the VHS model.

Equation (1): $C_y = C_0 \text{ erf } [Z/(2 \alpha_z Y)^{1/2}] \text{ erf } [X/4 (\alpha_t Y)^{1/2}]$

C_y = Contaminant concentration at the compliance point (mg/l)

C_0 = Contaminant concentration in the leachate (mg/l)

erf = error function (dimensionless)

Z = penetration depth of leachate into the aquifer (m)

Y = distance from disposal site to compliance point (m)

X = length of the disposal site measured in the direction perpendicular to the direction of groundwater flow (m)

α_t = lateral transverse (horizontal) dispersivity (m)

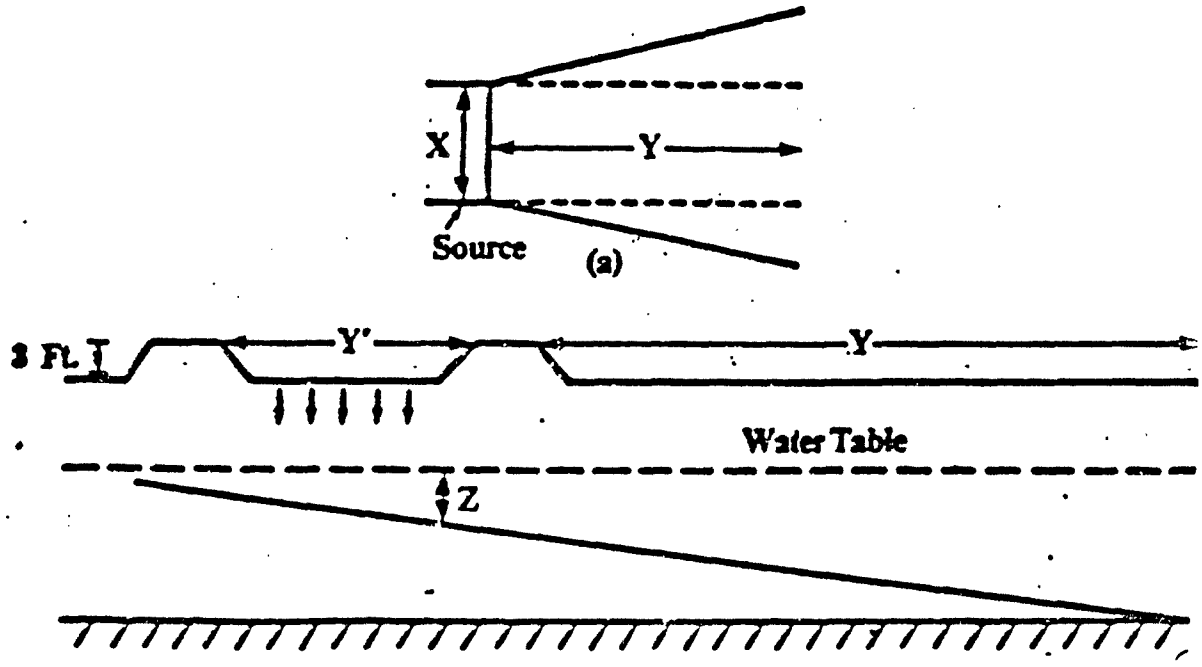
α_z = vertical dispersivity (m)

The model is based upon the premise that the waste being evaluted is placed in a 40-ft wide, 8-ft deep trench at a disposal site (i.e., landfill). The length of the trench is determined by the volume of waste. The orientation of the trench is such that the X direction is perpendicular to the direction of groundwater flow; the Y direction is parallel to the direction of groundwater flow; and the Z direction is into the underlying aquifer. That is, a left-handed coordinate system is used. (See Figure 1).

With the exception of the contaminant concentration in the leachate (C_0) and the length of the disposal site (X), all of the values for the model's parameters are fixed and will be applied in all waste evaluations. EPA has selected reasonable worst-case values for these fixed parameters. The significance of these fixed, as well as the waste-specific, parameters is discussed below.

The EPA adopted 2-term modifications which incorporate the dispersivity terms resulting in the following new equation, Equation (2).

Figure 1. Geometrical Spreading Of Contaminant Plume In A (a) Horizontal Plane and (b) Vertical Plane Where The Contaminant Occupies The Full Aquifer Thickness



Equation (2): $C_y = C_o \text{ erf } [(Y^1/4Y)]^{\frac{1}{2}} \text{ erf } [X/4(\alpha_t Y)^{\frac{1}{2}}]$

Y^1 = 12.2 meters (40 ft)

Y = 152.4 meters (500 ft)

α_t = 2 meters

V = 11,000 yd^3 = 297,000 ft^3

$X = \frac{297{,}000 \text{ ft}^3}{(40)(8)}$ = 928 ft long = 283 m

X = 283 m

Approach for Evaluating Organic Waste, Leachate Concentration:

The first value required by the model is the original leachate concentration entering the aquifer. All petitioners run a leaching test for metal-bearing wastes. Most petitioners would use the EP toxicity test to determine the mobile fraction unless EPA were to consider the EP toxicity test to be inadequate for the waste; persons who generate an oily waste would use an alternate leaching test devised by EPA - The Oily Waste EP.

For organics, however, calculating the concentration of each organic entering the aquifer is more difficult. EPA has noted that no acceptable leaching procedure for organics is available and that the EP leachate may not reflect the concentrations actually leached for organics.

EPA does believe that a general approach can be developed to estimate the leaching behavior of organic compounds and their subsequent mobility. Therefore, EPA has developed a simple mathematical relationship that predicts the leaching behavior of organics from a waste. Equation (3) fits best for the available data from all aqueous leaching media.

Equation (3): $C_o = BO \cdot C^X \cdot SY$

for C<1; x = y = 1; BO = 2.14E-05

for C>10; x = .71; y = .31; BO = .044

Where:

C_o = the predicted leachate concentration of the contaminant:

C = the concentration of the contaminant in the waste in ppm;

S = the contaminant's water solubility at ambient temperature (ususally between 18 and 25·C) in mg/l or ppm; and

BO = a constant selected in such a way to give values closest to observed C_o.

The EPA believes this relationship is the best available since it offers: (1) The best overall fit of the data at a 95% confidence level; and (2) the highest significance level of any relation evaluated. The Agency intends to use this approach to evaluate leachate concentrations of organics until the completion of efforts to develop a leaching procedures specifically for organic compounds.

C = is a predicted treatability value of less than 0.1 ppb for 2,3,7,8-TCDD, Calculated from a maximum Destruction Efficiency of the MIS treatment.

Since C <1; therfore X = Y = 1

$BO = 2.14 \times 10^{-5}$

S = 100 ppt = 1×10^{-4} ppm at 25°C

$C_o = BO \cdot C \cdot S$

$= (2.14 \times 10^{-5})(10^{-4})(10^{-4})$

C_o (ppm) = 2.14×10^{-13}

∴ C_o is a predicted leachate concentration of the contaminant.
C_o can therefore be inserted in the VHS equation (Equation 2).

$$C_y = 2.14 \times 10^{-13} \frac{mg}{l} \text{ erf } [(12.2/4(152.4))^{.5}] \text{ erf } [231/4(2 \times 152.4)^{.5}]$$

$$C_y = 2.14 \times 10^{-13} \text{ erf } (.141) \text{ erf } (4.04)$$
$$2.14 \times 10^{-13} (.158)(1)$$

$$C_y = 3.38 \times 10^{-14} \frac{mg}{l} = 3.38 \times 10^{-5} \text{ ppq}$$

This calculated C_y is the worst-case for 2,3,7,8-TCDD constituents. It assumes the average value of the waste at NCBC for 2,3,7,8-TCDD is 500 ppm before treatement, and the destruction efficiency of the incineration system will be 99.999% which will result in a residue of the waste in less than 0.1 ppb of 2,3,7,8-TCDD. Therefore, by using 2,3,7,8-TCDD as a controlling constituent of hazardous waste at NCBC, the result of the VHS model proves that the residues after treatment can be quantatively delisted. The concentration of 2,3,7,8-TCDD at the EPA compliance point is predicted to be below drinking water standards of ____ ppq. It will be 3.38×10^{-5} ppq, based on VHS model and instructions provided in 50 FR 48386-48910.

The Agency has not yet undertaken a study to determine what the probability distribution is for these assumptions. As stated above, the Agency recognizes that these assumptions will cause the model to be more conservative; however, we do not currently know to what extent. The Agency intends, as will be explained blow, to study these assumptions in light of actual distribution information and propose to make any changes that are appropriate. For the present, however, the Agency intends to make timely delisting decisions (as required by the Hazardous and Solid Waste Amendments of 1984) using the VHS model as explained in this notice.

Bias Against Large-Volume Wastes

Comment: Additional challenges addressed the VHS model's treatment of large-volume wastes, as well as the assumption that wastes are disposed on an annual basis. These respondents claimed that the Agency was creating an indefensible bias against large-volume hazardous waste generators.

Response: It was not the Agency's intention to create a bias against large volumes of hazardous waste. The Agency recognizes, however, that large sources of waste which leach a contaminant at a particular level will have a greater impact on an underlying aquifer than a small amount of waste leaching at the same (or even higher) level. One commenter eloquently summarized this finding as, "Although it is easy to quibble with the parameters used to provide these absolute numbers, or the distance taken to the so-called compliance point, it is difficult to argue against the logic that large sources are subject to less dilution." The Agency contends that, as waste volume increases, hazard potential also increases. The approach is justly weight against large-volume wastes. As discussed earlier, however, volume is only one of many factors considered in the Agency's evaluation.

3. Site-Specific Model Applications

The majority of comments received challenged the use of the VHS model without the consideration of site-specific conditions. These commenters felt that the Agency should use site-specific factors in the model or apply the model in a tiered fashion. (*i.e.*, consider site-specific waste management conditions if a waste did not satisfy the general version of the model). The following sections present the Agency's response to these issues.

Use of Site-Specific Factors or a Tiered Approach in Model Application

Comment: A majority of respondents recommended that the VHS model be modified to consider site-specific conditions. Many respondents stated that the VHS model parameter (*e.g.*, cell size, Z-parameter, dispersivity, receptor well distance) should reflect site conditions. Three of the respondents stated that actual hydrological and geological information (*e.g.*, distance to the nearest receptor well, hydraulic gradient) should also be incorporated into the analysis.

Several responents recommended that the Agency consider adopting a tiered application in which the VHS model would be used as the initial screen. Those petitioning facilities meeting the requirements of the VHS model evaluation procedure and the Agency's other remaining evaluation criteria would be delisted. Those facilities failing to meet the model conditions would have an opportunity to apply a second-level calculation using site-specific values. Failing this, a petitioner would be allowed to use a more "sophisticated" model in a third-level, and final, evaluation. These commenters argued that such a tiered approach would enable the Agency to examine more closely those petitions which fail the initial screening and to consider additional site-specific factors in the evaluation.

Response: Delisting decisions are site-specific, not disposal site-specific. They are formulated by evaluating the immediate and potential hazard of a petitioned waste in a non-RCRA regulated management setting. In order to make this evaluation, the Agency assumes that the waste will be managed at a non-regulated facility. For example, metal hydroxide sludges are managed by landfilling and are not normally incinerated or land treated. The Agency therefore assumes that metal hydroxide sludges will be disposed in a non-RCRA landfill. When a waste is delisted, it is no longer subject to hazardous waste control. That is, there are no hazardous waste requirements that generators of facilities must meet in managing their waste. Generators may dispose of their wastes on their own property or at any facility that will accept it.

For example, a generator may petition the Agency for delisting of a metal hydroxide sludge which is currently being managed in an on-site landfill and provide data on the nearest well, permeability of the aquifer, dispersivities, etc. If site-specific factors were considered, the Agency may use these factors in the model and judge that the waste, at that specific location, cannot affect the closest well and grant the petition. At the time the petition is granted, the generator is under no obligation to continue to manage the waste at the on-site landfill. In fact, it is likely that the generator will eventually reach the capacity of the on-site facility and subsequently send his waste off-site to a facility which may have very different hydrogeologic conditions. Furthermore, if the initial evluation was based on the nearest well being 1000 feet away, nothing would stop anyone from drilling a well closer. It could be argued that a well could not be drilled closer that the property boundary. The generator might, in the future, however, divide his property and sell a portion. Site-specific conditions can only be taken into account for as long as they may exist. In general, it cannot be guaranteed that the site-specific circumstances will not change. The Agency, therefore, believes that these conditions should not be part of its evaluation. The use of site-specific information supplied by the petitioner, therefore, does not support the evaluation of the petitioned waste.

Likewise, the Agency is unable to use a tiered approach since it would involve use of site-specific conditions. Since site-specific conditions are not considered, more sophisticated models would yield essentially the same results as the model the Agency proposed.

As indicated above, the Agency does not intend to take site-specific factors into account during delisting evaluations for wastes that are landfilled. The Agency also realizes, however, that there may be some cases where some site-specific factors may be introduced in other disposal scenarios. In such a case, the Agency would have to be convinced that it would not be feasible to manage the waste in any other manner and that the conditions at the site are such that they overshadow consideration of any other scenario or factors. For example the contaminated soil residue from a spill of a listed commercial chemcial product may be a candidate for consideration of some site-specific factors. Specifically, if the contaminated area were very large such that moving all of the contaminated soil would be infeasible, the Agency might consider the scenario of leaving the soil in place.

Waste Management Conditions for Site-Specific Delistings

Comment: Commenters argued that delistings should be granted subject to a given facility's agreement to meet specific waste management

Citations for two articles enclosed by the Derrington Letter:

1. Freeman, R. A. and Schroy, J. M., Modeling the Transport of 2,3,7,8-TCDD and other Low Volatility Chemicals in Soils, Environmental Progress, Vol. 5, No. 1, 28-33, February 1986.

2. Marple, L. Brunck, R. and Troop, L., Water Solubility of 2,3,7,8-Tetrachlorodibenzo-p-dioxin, Environmental, Sci. Technol., Vol. 20, No., 180-182, 1986.

VERSAR INC.

February 25, 1987

Mr. Myles Morse
Acting Section Chief
U.S. EPA Variances (Delisting) Section
Office of Solid Waste
410 M Street S.W. WH562B
Washington, D.C. 20460

Reference: United States Air Force Delisting Petition No. ID-0615

Dear Mr. Morse;

Enclosed are copies of the two articles we talked about in our meeting at EPA on 2-19-87. I have already spoken with Gwen de Poix and am sending her copies of these as well. Based on these solubilities (7.96 and 19.3 ppt) and the OHM/VHS models you've used, the required detection limits for the delisting of treated soil is still non-attainable (i.e., its in the range of 0.2 to 0.4 ppt). I am in the process of putting together the petition which we plan to submit within the next month.

In a recent conversation between Major Terry Stoddart (USAFESC) and Dr. Bob Harless (EPA/RTP), Dr. Harless stated that to his knowledge no technology currently exists which can routinely test materials, specifically soil, at detection limits near 0.07 ppt. As we promised we will be sending you the methods we used in our analysis and the best detection limits attainable using high resolution GC/MS.

If you have questions or suggestions that may assist me in preparing the delisting petition, please do not hesitate to call me at 750-3000.

Thank you;

Darrell B. Derrington, Jr. P.E.
enclosures

xc:
Gwen de Poix
Major Terry Stoddart, USAFESC
Harry Williams, EG&G Idaho, Inc.

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not found	Unstable	Volatile[A]	Comments	Analysis Reference	Matrix	Tech	Det Limit[B] (µg/kg)
Arsenic acid (Orthoarsenic acid)	CG0760000	10102-53-1	N	Y	X	X				Insecticide: soluble - 3 kg/L				
Arsenic pentoxide (Arsenic (V) oxide)	CG2275000	1303-28-2	N	Y	X	X				Insecticide: soluble				
Arsenic trioxide (Arsenic (III) oxide)	CG3325000	1327-53-3	N	Y	X	X				Insecticide: soluble				
Auramine (Benzenamine, 4,4'-carbonimidoylbis[N,N-Dimethyl]-monohydrochloride)	BF3500000	492-80-8	N	Y	X	X				Dye intermediate				
Azaserine (L-serine, diazoacetate (ester)	VT9625000	115-02-6	N	Y	X	X								
Barium and compounds, N.O.S.			N	Y	X	X								
Barium cyanide	CQ8765000	542-62-1	N	Y	X	X		X		Soluble - 800 g/L				
Benz[c]acridine (3,4-Benzacridine)	CU2975000	225-51-4	N	Y	X	X				Dyes & pharmaceutical				
Benz[a]anthracene(1,2-Benzanthracene)	CV9275000	56-55-3	Y	Y	X	X	X		HP-161		SW-846-8250			7.8
Benzene (Cyclohexatriene)	CY1400000	71-43-2	Y	Y	X	X	X		X, BO		SW-846-8020 SW-846-8240			NG 4.4
Benzenearsonic acid (Arsonic acid, phenyl-)	CY3150000	98-05-5	N	Y	X	X				Chem. reagent				
Benzene, dichloromethyl-(Benzal chloride)	CZ5075000	98-87-3	N	Y	X	X				Chem. reagent				1
Benzenethiol (Thiophenol)			N	Y	X	X			168					
Benzidine ([1,1'-Biphenyl]-4,4'-diamine)	DC9625000	92-87-5	Y	N	X	X				For dye manufacturing	SW-846-8250			44
Benzo(b)fluoranthene (2,3-Benzofluoranthene)	CU1400000	205-99-2	Y	N	X	X					SW-846-8250 SW-846-8310			4.8 0.018
Benzo(j)fluoranthene (7,8-Benzofluoranthene)	DF6300000	205-82-3	N	Y	X	X								
Benzo(a)pyrene (3,4-Benzopyrene)	BJ3675000	50-32-8	Y	N	X	X					SW-846-8100 SW-846-8250 SW-846-8310 SW-846-8310			NG 2.5 0.013 0.023
p-Benzoquinone (1,4-Cyclohexadienedione)	DK2625000	106-51-4	N	Y	X	X		X	HP-114					
Benzotrichloride (Benzene, trichloromethyl-)	EI9275000		N	Y	X	X			220					
Benzyl chloride (Benzene, (chloromethyl)-)	XS8925000		N	Y	X	X			179					
Beryllium and compounds, N.O.S.	0S1750000	7440-41-7	Y	Y	X	X	X				SW-846-8010			NG
Bis(2-chloroethoxy)methane (Ethane, [methylenebis(oxy)]bis[2-chloro-])	PA3675000	111-91-1	Y	N	X	X					SW-840-8010			NG
Bis(2-chloroethyl) ether (Ethane, oxybis[2-chloro-])	KN0875000	111-44-4	Y	Y	X	X	X			Used in chem. synthesis				
N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)	QM2450000	494-03-1	N	Y	X	X				Pharmaceutical				
Bis(2-chloroisopropyl) ether (Propane, 2,2'-oxybis[2-chloro-]			Y	N	X	X			187					

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Appendix VIII Constituent	RTECS Number	CAS Number	PPL Y/N	OBLIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
Acetonitrile (Ethanenitrile)	AL7700000	75-05-8	Y	Y	X	X			X, BD					
Acetophenone (Ethanone, 1-phenyl)	AM5250000	98-86-2	N	Y	X	X			202					
2-(alpha-Acetoxybenzyl)-4-hydroxycoumarin and salts (Warfarin)	GN6550000	81-81-2	N	Y	X	X				No salt soluble				
2-Acetylaminofluorene (Acetamide, N-(9H-fluoren-2-yl)-)	AB8450000	53-96-3	N	Y	X	X								
Acetyl chloride (Ethanoyl chloride)	AO5250000	75-36-5	N	Y	X	X			X, SD					
1-Acetyl 2-thiourea (Acetamide, N-(aminothioxomethyl)-)	AB1700000		N	Y	X	X								
Acrolein (2-Propenal)	AS1225000	107-02-8	Y	Y	X	X			X, SD	Very soluble	SW-846-8030			0.6
Acrylamide (2-Propenamide)	AS3325000	79-06-1	N	Y	X	X			NP-BD					
Acrylonitrile (2-Propenenitrile)	AT5250000	107-13-1	Y	Y	X	X			X		SW-846-8030			0.5
Aflatoxins	AH5950000	1402-68-2	N	Y	X	X				Plant viral toxin, fungus metabolite				
Aldrin (1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a,-hexahydro-endo,exo-1,4:5,8-dimethanonaphthalene)	IO2100000	309-00-2	Y	Y	X	X	X			Insecticide	SW-846-8030 SW-846-8250			.004 1.9
Allyl alcohol (2-Propen-1-ol)	BA5425000	107-18-6	N	Y	X	X			X, SD					
Aluminum phosphide	BD1400000	20859-73-8	N	Y	X	X		A	X	Dye intermediate				
4-Aminobiphenyl ([1,1'-Biphenyl]-4-amine)	DU9975000		N	Y	X	X								
6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methyl-carbamate azirino(2',3':3,4)pyrrolo(1,2-a)indole-4,7-dione, 6-amino-8-((aminocarbonyl)oxymethyl)-1,1a,2,8,8a,8b-hexahydro-8amethoxy-5-methyl-	CB9750000	50-07-7	N	Y	X	X				Pharmaceutical				
5-Aminomethyl-3-isoxazolol (3(2H)-Isoxazolone, 5-(aminomethyl)-)	NT1325000	7763-96-6	N	Y	X	X								
Aminopropanol (1-Propanol, 3-amino)	UC3850000		N	Y	X	X								
Aniline (Benzenamine)	BW6650000	62-53-3	N	Y	X	X	X		18D	Chem. reagent				
Antimony and compounds, N.O.S.	CC4025000	7440-36-0	Y	Y	X	X	X							
Arsenic (As) trioxide, 2-chloroethyl-,[6-(1,1-dimethylethyl)phenoxy]-methyl ester)	WI2975000	140-57-8	N	Y	X	X								
Arsenic and compounds, N.O.S.	CG0525000	7440-38-2	Y	N	X	X				Insecticide				

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Appendix VIII (constituent)	RCRIS Number	CAS Number	PQL V/W	DELIST[a] V/W	Reason Not Expected	No History	Not Found	Unstable	Volatile	Comments	Analysis Reference	Matrix	Tech	Det Limit (µg/kg)
Arsenic acid (Orthoarsenic acid)	C667x00.00	10142-53-1	W	V	X	X				Insecticide: soluble - 3 kg/L				
Arsenic pentoxide (Arsenic (V) oxide)	C027X5000	1303-28-2	W	V	X	X				Insecticide: soluble				
Arsenic trioxide (Arsenic (III) oxide)	C033X5000	1327-53-3	W	V	X	X				Insecticide: soluble				
Auramine (Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl-monohydrochloride)	C035X0000	492-80-8	W	V	X	X				Dye intermediate				
Bis(chloromethyl) ether (Dichloromethyl ether)	B146.5000	111-44-4	W	V	X	X								
Barium and Compounds, N.O.S.			W	V	X	X								
Barium cyanide	C0B7B5300	542-62-1	W	V	X	X		X		Soluble - 400 g/L				
Benz[c]acridine (3,4-Benzacridine)	C029Y5300	225-51-4	W	V	X	X				Dyes & pharmaceutical				
Benz[a]anthracene (1,2-Benzanthracene)	C092Y5000	56-55-3	V	V	X	X	X		MP=161		SW-846-8250			7.7
Benzene (Cyclohexatriene)	C016X0000	71-43-2	V	V	X	X	X		B, BD		SW-846-8020 SW-846-8240			BQ 4.4
Benzenearsonic acid (Arsonic acid, phenyl-)	C033X0000	98-05-5	W	V	X	X				Chem. reagent				
Benzene, 6-(trichloromethyl)- (Benzal chloride	C252 5000	98-87-3	W	V	V	V				Chem. reagent				
Benzenethiol (Thiophenol)			W	V	X	X			169					
Benzidine ([1,1'-Biphenyl]-4,4'-diamine)	3A9625000	92-87-5	V	W	V	X				For dye manufacturing	SW-846-8250			BQ
Benzo[b]fluoranthene (2,3-Benzofluoranthene)	CB14000GF	205-99-2	V	W	X	X					SW-846-8256 SW-846-5310			4.9 0.018
Benzo[j]fluoranthene (7,8-Benzofluoranthene)	SF630X5000	205-82-3	W	V	X	X								
Benzo[a]pyrene (3,4-Benzopyrene)	B.36?5000	50-32-8	V	W	V	X					SW-846-8100 SW-846-8250 SW-846-8310 SW-846-8310			BQ 2.5 0.013 0.023
p-Benzoquinone (1,4-Cyclohexadienedione)	3R1625000	106-51-4	W	V	X	X		X	MP=114					
Benzotrichloride (Benzene, [trichloromethyl]-)	B197Y5000		W	V	X	X			220					
Benzyl chloride (Benzene, (chloromethyl)-)	B589Y5000		W	V	X	X			179					
Beryllium and Compounds, N.O.S.	B117Y5000	7440-41-7	V	V	X	X	X				SW-846-6010			BQ
Bis(2-chloroethoxy)methane (Ethane, methylenebis(oxy)bis[2-chloro-])	PA36?5000	111-91-1	V	W	X	X					SW-840-8010			BQ
Bis(2-chloroethyl) ether (Ethane, oxybis[2-chloro-])	E8G87S000	111-44-4	V	V	X	X	X			Used in chem. synthesis				
Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)	2N1450000	494-03-1	W	V	X	X				Pharmaceutical				
Bis(chloroisopropyl) ether (Propane, 2,2'-oxybis[2-chloro-]			V	W	X	X			187					

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Aggregate Pill Constituent	RTECS Number	CAS Number	PPL Y/N	RBLISI Y/N	Reason Put Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
Bis(chloromethyl) ether (Methane, oxybis[chloro-])	KN1575000	111-44-4	N	Y	X	X		X		Pharmaceutical				
Bis(2-ethylhexyl) phthalate (1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester)	TI0350000	117-81-7	Y	Y	X	X	X			Used in vacuum pumps.	SW-846-8060 SW-846-8060 SW-846-8270			2.0 20 2.5
Bromoacetone (2-Propanone, 1-bromo-)	UC05750000		N	Y	X	X			1.96					
Bromomethane (Methyl bromide)	PA4900000	74-83-9	Y	Y	X	X	X		2, 3.56		SW-846-8010 SW-846-8240			NG NG
4-Bromophenyl phenyl ether (Benzene, 1-bromo-4-phenoxy-)			Y	Y	X	X	X							
Brucine (Strychnidin-10-one, 2,3-dimethoxy-)	EH9475000	357-57-3	N	Y	X	X								
2-Butanone peroxide (Methyl ethyl ketone, peroxide)	EL9450000	1338-23-4	N	Y	X	X		X						
Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butyl phenyl-methyl ester)	TI0990000	85-68-7	Y	Y	X	X	X			Pharmaceutical Insect repellant	SW-846-8250			2.5
2-sec-Butyl-4,6-dinitrophenol (DNBP) (Phenol, 2,4-dinitro-6-(1-methylpropyl)-)	SJ5600000	88-85-7	N	Y	X	X				Used in dye manufacturing				
Cadmium and compounds, R.Q.S.	EU9800000	7440-43-9	Y	Y	X	X	X							
Calcium chromate (Chromic acid, calcium salt)	GB2750000	13765-19-0	N	Y	X	X				Water soluble (163 g/L)				
Calcium cyanide	EW0700000	592-01-8	N	Y	X	X				Decomposes in water				
Carbon disulfide (Carbon bisulfide)	FF6650000	75-15-0	N	Y	X	X	X		X					
Carbon oxyfluoride (Carbonyl fluoride)	FG6125000	353-50-4	N	Y	X	X			1.83					
Chloral (Acetaldehyde, trichloro-)	AM8750000	302-17-0	N	Y	X	X			1 97.5	Water soluble				
Chlorambucil (Butanoic acid, 4-[bis(2-chloroethyl)amino]benzene-)	EI3675000	305-03-3	N	Y	X	X				Pharmaceutical				
Chlordane (alpha and gamma isomers) (4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3,4,7,7a-tetrahydro-)(alpha and gamma isomers)	PB9800000	57-74-9	Y	Y	X	X	X			Pharmaceutical Insecticide	SW-846-8250			NG
Chlorinated benzenes, N.O.S. [a]	Mixture		Y	N	X	X								
Chlorinated ethane, N.O.S.	Mixture		N	Y	X	X			X					
Chlorinated fluorocarbon, N.O.S.	Mixture		N	Y	X	X			X					
Chlorinated naphthalene, N.O.S.	Mixture		N	Y	X	X								
Chlorination phenol, N.O.S. [a]	Mixture		N	N	X	X				Possibly present				
Chloroacetaldehyde (Acetaldehyde, chloro-)	AB2450000	107-20-0	N	Y	X	X			X, 85					

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	BELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
Chloroalkyl ethers, N.O.S.	Mixture	X	N	Y	X	X								
p-Chloroaniline (Benzenamine, 4-chloro-)	BX0700000	106-47-8	N	Y	X	X								
Chlorobenzene (Benzene, chloro-)	CZ0175000	108-90-7	Y	Y	X	X	X		X		SW-846-8010 SW-846-8240			0.25 6.0
Chlorobenzilate (Benzeneacetic acid, chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester)	BD2275000	510-15-6	N	Y	X	X				Pharmaceutical insecticide (solders & mites)				
2-Chloro-1,3-butadiene (chloroprene)	EI9625000	126-99-8	N	Y	X	X				Polymer manufacturing				
p-Chloro-m-cresol (Phenol, 4-chloro-3-methyl)	GQ7100000	59-50-7	Y	Y	X		X							
1-Chloro-2,3-epoxypropane (Oxirane, (chloromethyl)-) (Epichlorohydrin)	RP0875000	106-92-3	N	Y	X	X				Rubber solvent and polymer manufacturing				
2-Chloroethyl vinyl ether (Ethene, (2-chloroethoxy)-)	KM6300000	110-75-8	Y	Y	X	X	X			Pharmaceutical				
Chloroform (Methane, trichloro-)	FS9100000	67-66-3	Y	Y	X	X	X		X		SW-846-8010 SW-846-8240			0.05 1.6
Chloromethane (Methyl chloride)	PA6300000	74-87-3	Y	Y	X	X	X		X		SW-846-8010 SW-846-8240			0.08 BG
Chloromethyl methyl ether (Methane, chloromethoxy-)	KM6650000	107-30-2	N	Y	X	X			X, 59					
2-Chloronaphthalene (Naphthalene, beta-chloro-)	QJ2275000	91-58-7	Y	Y	X	X	X				SW-846-8120			0.94
2-Chlorophenol (Phenol, o-chloro-)	SK1675000	95-57-8	Y	Y	X	X	X			Possibly present	SW-846-8040 SW-845-8040 SW-846-8250			0.33 0.58 3.3
1-(o-Chlorophenyl) thiourea (Thiourea, (2-chlorophenyl)-)	YS7100000	5344-82-1	N	Y	X	X								
3-Chloropropene (allyl chloride)	UC7350000	107-05-1	N	Y	X	X			X					
3-Chloropropionitrile (Propanenitrile, 3-chloro-)	UE1400000	542-76-7	N	Y	X	X			X, 97	Soluble in water				
Chromium and compounds, N.O.S.	GH1700000	7440-47-3	Y	N	X	X								
Chrysene (1,2-Benzophenanthrene)	GC0700000	218-01-9	Y	N	X	X					SW-846-8100 SW-846-8250 SW-846-8310			BG 2.5 0.15
Citrus red No. 2 (2-Naphthol, 1-[(2,5-dimethoxyphenyl)azo]-)	QL3675000	6358-53-8	N	Y	X	X				Used to color orange skins				
Coal tars***	GF8600000	8007-45-2	N	N						Primarily a pharmaceutical				
Copper cyanide	GL7150000	544-92-3	N	Y	X	X				Salts contain Cu soluble in KCN, $Ca(OH)_2$ & decomposes in water				
Creosote (Creosote, wood)***	GF8615000	8001-58-9	N	N						Some components possibly present				
Cresols (Cresylic acid) (Phenol, methyl-)***	GO5950000	1319-77-3	N	N	X	X				Possibly present	SW-846-8040			BG
Crotonaldehyde (2-Butenal)	GP9675000	123-73-9	N	Y	X	X			104-5					
Cyanides (soluble salts and complexes), N.O.S.	GS7175000	57-12-5	Y	Y	X	X	X			Water soluble				
Cyanogen (Ethanedinitrile)	GV9525000	460-19-5	N	Y	X	X			-21	Water soluble decomposes in water				

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
Cyanogen bromide (Bromine cyanide)	GT2100000	506-68-3	N	Y	X	X			X, 61.4					
Cyanogen chloride (Chlorine cyanide)	GT2275000	506-77-4	N	Y	X	X			X, 12.7					
Cycasin (beta-D-Glucopyranoside, (methyl-ONN-azoxy)methyl-)	LZ5950000	14901-08-7	N	Y	X	X								
2 Cyclohexyl-4,6-dinitrophenol (Phenol, 2-cyclohexyl-4,6-dinitro-)	SK6650000	131-89-5	N	Y	X	X				Insecticide for red mite				
Cyclophosphamide (2H-1,3,2,-Oxazaphosphorine, [bis(2-chloroethyl)amino]-tetrahydro-, 2-oxide)	RP5550000	50-18-0	N	Y	X	X				Pharmaceutical				
Daunomycin (5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl]oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-)	NQ7875000	20830-81-3	N	Y	X	X				Pharmaceutical				
DDD (Dichlorodiphenyldichloroethane) (Ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-)	KI0700000	72-54-8	Y	Y	X	X	X			Insecticide	SW-846-8250			2.6
DDE (Ethylene, 1,1-dichloro-2,2-bis(4-chlorophenyl)-)	KV9450000	72-55-9	Y	Y	X	X	X			Insecticide	SW-846-8250			5.6
DDT (Dichlorodiphenyltrichloroethane) (Ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-)	KJ3325000	50-29-3	Y	Y	X	X	X			Insecticide	SW-846-8250			4.7
Diallate (S-(2,3-dichloroallyl)diisopropylthiocarbamate)	EZ8225000	2303-16-4	N	Y	X	X				Herbicide				
Dibenz[a,h]acridine (1,2,5,6-Dibenzacridine)	NR0875000	226-36-8	N	Y	X	X				Complex polynuclear				
Dibenz[a,j]acridine (1,2,7,8-Dibenzacridine)	NR1050000	224-42-0	N	Y	X	X				Complex polynuclear				
Dibenz[a,h]anthracene (1,2,5,6-Dibenzanthracene)	HN2625000	53-70-3	Y	N	X	X				Complex polynuclear	SW-846-8100 SW-846-8250 SW-846-8310			NG 2.5 0.030
7H-Dibenzo[c,g]carbazole (3,4,5,6-Dibenzcarbazole)	HO5400000	194-59-2	N	Y	X	X				Complex polynuclear				
Dibenzo[a,e]pyrene (1,2,4,5-Dibenzpyrene)	GL1750000	192-65-4	N	Y	X	X				Complex polynuclear				
Dibenzo[a,h]pyrene (1,2,5,6-Dibenzpyrene)	HO5775000	189-64-0	N	Y	X	X				Complex polynuclear				
Dibenzo[a,i]pyrene (1,2,7,8-Dibenzpyrene)	BI5750000	189-55-9	N	Y	X	X				Complex polynuclear				
1,2-Dibromo-3-chloropropane (Propane, 1,2-dibromo-3-chloro-)	TL8750000	96-12-8	N	Y	X	X								
1,2-Dibromoethane (Ethylene dibromide)	KH9275000	106-93-4	N	Y	X	X								
Dibromomethane (Methylene bromide)	PA7350000	74-95-3	N	Y	X	X			X 95					
Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)	TI0875000	84-74-2	Y	Y	X	X	X			Insect repellant	SW-846-8060 SW-846-8060 SW-846-8250			0.36 31 2.9
o-Dichlorobenzene (Benzene, 1,2-dichloro-)	CZ4500000	95-50-1	Y	Y	X	X	X		180.5	Sublimes possibly present	SW-846-8010 SW-846-8120 SW-846-8240 SW-846-8250			0.15 1.14 NG 1.9
m-Dichlorobenzene (Benzene, 1,3-dichloro-)		541-73-1	Y	Y	X	X	X		173	Sublimes Possibly present	SW-846-8010 SW-846-8120 SW-846-8240 SW-846-8250			0.32 1.19 NG 1.9

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Appendix VIII Constituents	NIOSH Number	CAS Number	PQL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Lim[b] (µg/kg)
p-Dichlorobenzene (Benzene, 1,4-dichloro-)	CZ4550000	106-46-7	Y	Y	X	X	X		174	Sublimes Possibly present	SW-846-8010 SW-846-8120 SW-846-8240 SW-846-8250			0.24 1.34 NG 4.4
Dichlorobenzene, N.O.S. (Benzene, dichloro-, N.O.S.)	Mixture		N	Y	X	Y				Sublimes Possibly present				
3,3'-Dichlorobenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-)	DD0525000	91-94-1	Y	N	X	X				Dye manufacturing	SW-846-8250			16.5
1,4-Dichloro-2-butene (2-Butene, 1,4-dichloro-)	EM4900000	764-41-0	N	Y	X	X				Plastics manufacturing				
Dichlorodifluoromethane (Methane, dichlorodifluoro-)	PA8200000	75-71-8	N	Y	X	X			X, -28					
1,1-Dichloroethane (Ethylidene dichloride)	KI0175000	75-34-3	Y	Y	X	X	X		X		SW-846-8010 SW-846-4.7			0.07
1,2-Dichloroethane (Ethylene dichloride)	KI0525300	107-06-2	Y	Y	X	X	X		X, 83		SW-846 8010 SW-846-8240			0.03 2.5
trans-1,2-Dichloroethene (1,2-Dichloroethylene)	KV9400000	156-60-5	Y	Y	X	X	X		X, 48		SW-846-8010 SW-846-8240			0.10 1.6
Dichloroethylene, N.O.S. (Ethene, dichloro-, N.O.S.)	Mixture		N	Y	X	X			X					
1,1-Dichloroethylene (Ethene, 1,1-dichloro-)	KV9275000	75-35-4	Y	Y	X	X	X		X		SW-846-8010 SW-846-8240			NG 2.8
Dichloromethane (Methylene chloride)	PA8050000	75-09-2	Y	Y	X	X	X		X, 40		SW-846-8010 SW-846-8240			NG 2.8
2,4-Dichlorophenol (Phenol, 2,4-dichloro-)	SK8575000	120-83-2	Y	N	X	X			210		SW-846-8040 SW-846-8040			0.39 0.63
2,6-Dichlorophenol (Phenol, 2,6-dichloro-) ooo	SK8750000	87-65-0	N	N	X	X			219		SW-846-8040 SW-846-8250			NG 2.7
2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)o	AG6825000	94-75-7	Y	N						Possibly present	SW-846-8150			1.0
Dichlorophenylarsine (Phenyl dichloroarsine)	CH5425000	696-28-6	N	Y	X	X								
Dichloropropane, N.O.S. (Propane, dichloro-, N.O.S.)	Mixture		N	Y	X	X			X					
1,2-Dichloropropane, N.O.S. (Propane, dichloro-, N.O.S.) (Propylene dichloride)	UC8300000	563-54-2	Y	Y	X	X	X		X 95		SW-846-8010 SW-846-8240			0.04 6.0
Dichloropropanol, N.O.S. (Propanol, dichloro-, N.O.S.)	Mixture		N	Y	X	X			150 - 174					
Dichloropropene, N.O.S. (Propene, dichloro-, N.O.S.)	Mixture		N	Y	X	X			X					
1,3-Dichloropropene (1-Propene, 1,3-dichloro-)	UC8310000	542-75-6	Y	Y	X	X	X		X		SW-846-8010 SW-846-8240			0.34 5.0, NG
Dieldrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo-exo-1,4:5,8-dimethanonaphthalene)	IO1750000	60-57-1	Y	Y	X	X	X				SW-846-8250			2.5
1,2:3,4-Diepoxybutane (2,2'-Bioxirane)	EJ8225000	1464-53-5	N	Y	X	X			4					
Diethylarsine (Arsine, diethyl-)	CH7325000	4964-27-6	N	Y	X	X			105					
N,N-Diethylhydrazine (Hydrazine, 1,2-diethyl)	HY2275000	1615-80-1	N	Y	X	X		X	X, 85 - 86					

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Appendix VIII Constituents	RTECS Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Lim[b] (µg/kg)
O,O-Diethyl S-methyl ester of phosphorodithioic acid (Phosphorodithioic acid, O,O-diethyl S-methyl ester)	TD9670000	3288-582	N	Y	X	X								
O,O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosphoric acid, diethyl p-nitrophenyl ester)	TC2275000	311-45-5	N	Y	X	X								
Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)	TI0500000	84-66-2	Y	Y	X	X	X				SW-846-8060 SW-880-8060 SW-846-8250			0.49 31 22
O,O-Diethyl O-2-pyrazinyl phosphorothioate (Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester)			N	Y	X	X								
Diethylstilbesterol (4,4'-Stilbenediol, alpha, alpha-diethyl, bis(dihydrogen phosphate, (E)-)	WJ5600000	56-33-1	N	Y	X	X				Pharmaceutical				
Dihydrosafrole (Benzene, 1,2-methylene-dioxy-4-propyl-)	DA6125000	94-58-6	N	Y	X	X				Pharmaceutical				
3,4-Dihydroxy-alpha-(methylamino)methyl benzyl alcohol (1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-)	DO2625000	51-43-4	N	Y	X	X								
Diisopropylfluorophosphate (DFP) (Phosphorofluoridic acid, bis(1-methylethyl) ester)	TE5075000	55-91-4	N	Y	X	X								
Dimethoate (Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl]ester)	TE1750000	60-51-5	N	Y	X	X								
3,3-Dimethoxybenzidine ([1,1'-Biphenyl]-4,4'diamine, 3,3'-dimethoxy-)	DD0875000	119-90-4	N	Y	X	X								
p-Dimethylaminoazobenzene (Benzenamine, N,N-dimethyl-4-(phenylazo)-)	BX7350000	60-11-7	N	Y	X	X				Dye manufacturing				
7,12-Dimethylbenz[a]anthracene (1,2-Benzanthracene, 7,12-dimethyl-)	CV3850000	57-97-6	N	Y	X	X								
3,3'-Dimethylbenzidine ([1,1'-Biphenyl]-4,4'diamine, 3,3'-dimethyl-)	DD1225000	119-93-7	A	Y	X	X				Dye manufacturing				
Dimethylcarbamoyl chloride (Carbamoyl chloride, dimethyl-)	FD4200000	79-44-7	N	Y	X	X		X	X					
1,1-Dimethylhydrazine (Hydrazine, 1,1-dimethyl-)	MV2450000	57-14-7	N	Y	X	X			X, 62					
1,2-Dimethylhydrazine (Hydrazine, 1,2-dimethyl-)	MV2625000	540-73-8	N	Y	X	X			X, 81					
3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino) carbonyl]oxime (Thiofanox)	EL8200000	39196-18-4	N	Y	X	X								
alpha, alpha-Dimethylphenethylamine (Ethanamine, 1,1-dimethyl-2-phenyl-)	SH4025000	122-09-8	N	Y	X	X								
2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)	ZE5600000	105-67-9	Y	/	X	X	X		Hp23	2, 4 - Xylenol	SW-846-8040 SW-846-8040 SW-846-8250			0.32 0.77 2.7
Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)	TI1575000	131-11-3	Y	Y	X	X	X				SW-846-8060 SW-846-8060 SW-846-8250			0.29 1.9 1.6
Dimethyl sulfate (Sulfuric acid, dimethyl ester)	WS8225000	77-78-1	N	Y	X	X			X	Decomposes @ 188 Chem. reagent				
Dinitrobenzene, N.O.S. (Benzene, dinitro-, N.O.S.)	Mixture		N	Y	X	X								

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Lim[b] (µg/kg)
4,6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)	GO9625000	534-52-1	Y	N	X	X			Mo86					
2,4-Dinitrophenol (Phenol, 2,4-dinitro-)	SL2800000	51-28-5	Y	N	X	X			Mo113		SW-846-8040 SW-846-8040 SW-846-8250			13.0 NG 47
2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)	XT1575000	121-14-2	Y	N	X	X					SW-846-8090 SW-846-8250			0.06 5.7
2,6-Dinitrotoluene (Benzene, 1-methyl-2,6-dinitro-)	XT1925000	606-20-2	Y	N	X	X					SW-846-8090 SW-846-8250			0.06 1.6
Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)	TI1925000	117-81-7	Y	Y	X	X	X			Insect repellant	SW-846-8060 SW-846-8060 SW-846-8250			3.0 31 2.5
1,4-Dioxane (1,4-Diethylene oxide)	JG8225000	123-91-1	N	Y	X	X			Bp62 Mp12					
Diphenylamine (Benzenamine, N-phenyl-)	JJ7800000	123-39-4	N	Y	X	X			Bp302 Mp53					
1,2-Diphenylhydrazine (Hydrazine, 1,2-diphenyl-)	MV2625000	122-66-7	N	Y	X	X			Mp123					
Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)	JL9700000	621-64-7	N	Y	X	X				Insecticide				
Disulfoton (O,O-diethyl S-[2-(ethylthio)ethyl]phosphorodithioate)	ID9275000	298-04-4	N	Y	X	X				Plasticizer				
2,4-Dithiobiuret (Thioimidodicarbonic diamide)	EC1575000	541-53-7	N	Y	X	X				Insecticide	SW-846-8080 SW-846-8250			0.004-0.066 NG
Endosulfan (5-Norbornene, 2,3-dimethanol, 1,4,5,6,7,7-hexachloro-, cyclic sulfite)	RB9275000	115-29-7	Y	Y	X	X	X			Insecticide	SW-846-8080 SW-846-8250			0.006- 0.023 NG
Endrin and metabolites (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo, endo-1,4:5,8-dimethanonaphthalene, and metabolites)	IO1575000	72-20-8	Y	Y	X	X				Insecticide				
Ethyl carbamate (Urethan) (Carbamic acid, ethyl ester)	FA8400000	51-79-6	N	Y	X	X			182	Very soluble in H_2O Plastics manufacturing				
Ethyl cyanide (propanenitrile)	UF9625000		N	Y	X	X			X, 97	Very soluble in H_2O				
Ethylenebisdithiocarbamic acid, salts and esters (1,2-Ethanediylbiscarbamodithioic acid, salts and esters)	FA6825000	142-59-6	N	Y	X	X								
Ethylenimine (Aziridine)	KX5075000	151-56-4	N	Y	X	X			X, 56	Miscible in H_2O				
Ethylene oxide (Oxirane)	KX2450000	75-21-8	N	Y	X	X			X, 11	Soluble in H_2O				
Ethylenethiourea (2-Imidazolidinethione)	NI9625000	96-45-7	N	Y	X	X								
Ethyl methacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)	OZ4550000	97-63-2	N	Y	X	X			110					
Ethyl methanesulfonate (Methanesulfonic acid, ethyl ester)	PB2100000	62-50-0	N	Y	X	X			X, 86					

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Appendix VIII Constituents	NIOSH Number	CAS Number	[illegible] Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Lim[b] (µg/kg)
Fluoranthene (Benzo[j,k]fluorene)	LL4025000	206-44-0	Y	N	X	X	X				SW-846-8[illegible] SW-846-8250 SW-846-8310			NG 2.2 0.21
Fluorine	LM6475000	7782-41-4	N	Y	X	X		X	X					
2-Fluoroacetamide (Acetamide, 2-fluoro-)	AC1225000	640-19-7	N	Y	X	X				Soluble				
Fluoroacetic acid, sodium salt (Acetic acid, fluoro-, sodium salt)	AH5950000	144-49-0	N	Y	X	X			165					
Formaldehyde (Methylene oxide)	LP8925000	50-00-0	N	Y	X	X			X, -21					
Formic Acid (Methanoic acid)	LQ4900000	64-18-6	N	Y	X	X			X, 100					
Glycidylaldehyde (1-Propanol-2,3-epoxy)	HB3150000	765-34-4	N	Y	X	X		X						
Halomethane, N.O.S.	Mixture		N	Y	X	X			X					
Heptachlor (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-)	PC0700000	76-44-8	Y	Y	X	X	X			Insecticide	SW-846-8080 SW-846-8250			0.004 1.9
Heptachlor epoxide (alpha, beta, and gamma isomers) (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-2,3-epoxy-3a,4,7,7-tetrahydro-, alpha, beta, and gamma isomers)	PB9450000	1024-57-3	Y	Y	X	X	X			Insecticide	SW-846-8080 SW-846-8250			0.083 2.2
Hexachlorobenzene (Benzene, hexachloro-)	DA2975000	118-74-1	Y	Y	X	X	X			Fungicide and wood preservative	SW-846-8080 SW-846-8120 SW-846-8250			0.004-0.009 0.05 1.9
Hexachlorocyclohexane (all isomers) (Lindane and isomers)	GV3150000	608-73-1	Y	Y	X	X	X		113	Fungicide and wood preservative	SW-846-8080			0.004-0.009
Hexachlorocyclopentadiene (1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-)	GY1225000	77-47-4	Y	Y	X	X	X			Fungicide and wood preservative	SW-846-8120 SW-846-8250			NG NG
Hexachlorodibenzo-p-dioxins**	HP3200000	34465-46-8	N	N						Possibly present				
Hexachlorodibenzofurans**	Mixture		N	N						Possibly present				
Hexachloroethane (Ethane, 1,1,1,2,2,2-hexachloro-)	KI4025000	67-72-1	Y	Y	X	X	X				SW-846-8120 SW-846-8250			0.03 1.6
1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo, endo-dimethanonaphthalene (Hexachlorohexahydro-endo, endo-dimethanonaphthalene)	IO1925000	465-73-6	N	Y	X	X				Pharmaceutical Germicide				
Hexachlorophene (2,2'-Methylenebis(3,4,6-trichlorophenol)	SN0700000	70-30-4	N	Y	X	X								
Hexachloropropene (1-Propene, 1,1,2,3,3,3-hexachloro-)	UD0175000	1888-71-7	N	Y	X	X								
Hexaethyltetraphosphate (tetraphosphoric acid, hexaethyl ester)	XF1575000	757-58-4	N	Y	X	X								
Hydrazine (Diamine)	HU7175000	302-01-2	N	Y	X	X		X	113					
Hydrocyanic acid (Hydrogen cyanide)	MW6825000	74-90-8	N	Y	X	X		X	X, 26	Soluble in H_2O				
Hydrofluoric acid (Hydrogen fluoride)	MW7875000	7664-39-3	N	Y	X	X			X, 19	Soluble in H_2O				

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Lim[b] (µg/kg)
Hydrogen sulfide (Sulfur hydride)	MX1225000	7783-06-4	N	Y	X	X		X	X,-61	Soluble in H_2O				
Hydroxydimethylarsine oxide (Cacodylic acid)***	CH7525000	75-60-5	N	N						Soluble in H_2O				
Indeno(1,2,3-cd)pyrene (1,10-(1,2-phenylene)pyrene)	NK9300000	193-39-5	Y	N	X	X				Very soluble in H_2O				
Iodomethane (Methyl iodide)	PA9450000	74-88-4	N	Y	X	X			X, 42		SW-846-8120 SW-846-8250 SW-846-8310			NG 3.7 0.043
Iron dextran (Ferric dextran)	NO9450000	9004-66-4	N	Y	X	X				Pharmaceutical				
Isocyanic acid, methyl ester (Methyl isocyanate)	NQ9450000	624-83-9	N	Y	X	X		X	X					
Isobutyl alcohol (1-Propanol, 2-methyl-)	NP9625000	78-83-1	N	Y	X	X			107					
Isosafrole (Benzene, 1,2-methylenedioxy-4-allyl-)	DA5950000	120-58-1	N	Y	X	X				Used in perfumes				
Kepone (Decachlorooctahydro-1,3,4-Metheno-2H-cyclobuta[c,d] penta...en-2-one)	PC8575000	143-50-0	N	Y	X	X								
Lasiocarpine (2-Butenoic acid, 2-methyl-, 7-[(2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy)methyl]-2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester)	OE7875000	303-34-4	N	Y	X	X				Pharmaceutical Natural product				
Lead and compounds, N.O.S.	OF7525000	7439-92-1	Y	N	X	X				Naturally occurring				
Lead acetate (Acetic acid, lead salt)	AI5250000		N	Y	X	X				Naturally occurring & very soluble in H_2O				
Lead phosphate (Phosphoric acid, lead salt)	OG3675000	7446-27-7	N	Y	X	X				Naturally occurring & slightly soluble in H_2O				
Lead subacetate (Lead, bis(acetato-O)tetrahydroxytri-)	OF8750000	1335-32-6	N	Y	X	X				Naturally occurring & very soluble in H_2O				
Maleic anhydride (2,5-Furandione)	ON9625000	110-16-7	N	Y	X	X		X	197-200	Soluble in H_2O				
Maleic hydrazide (1,2-Dihydro-3,6-pyridazinedione)	UR5950000	123-33-1	N	Y	X	X				Soluble in H_2O Plant growth retardant.				
Malononitrile (Propanedinitrile)	OO3150000	109-77-3	N	Y	X	X			218	Soluble in H_2O				
Melphalan (Alanine, 3-[p-bis(2-chloroethyl)amino]phenyl-, L-)	AY3675000	148-82-3	N	Y	X	X								
Mercury fulminate (Fulminic acid, mercury salt)	OW4050000	628-86-4	N	Y	X	X		X		Slightly soluble in H_2O Naturally occurring				
Mercury and compounds, N.O.S.	OV4550000	7439-97-6	Y	Y	X	X	X			Naturally occurring				
Methylacrylonitrile (2-Propenenitrile, 2-methyl-)	UD1400000	126-98-7	N	Y	X	X				Chemical intermediate				
Methanethiol (Thiomethanol)	PB4375000	74-93-1	N	Y	X	X			X, 6.2	Soluble in H_2O				
Methapyrilene (Pyridine, 2-[(2-dimethylamino)ethyl]-2-thenylamino-)	UT1400000	91-80-5	N	Y	X	X				Pharmaceutical (antihistamine)				
Methomyl (Acetimidic acid, N-[(methylcarbamoyl)oxy]thio-, methyl ester	AK2975000	16752-77-5	N	Y	X	X				Insecticide				

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
Methoxychlor (Ethane, 1,1,1-trichloro-2,2'-bis(p-methoxyphenyl)-)	KJ3675000	72-43-5	N	Y	X	X	X			Insecticide				
2-Methylaziridine (1,2-Propylenimine)	CH8050000	75-55-8	N	Y	X	X		X		Very reactive				
3-Methylcholanthrene (Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-)	FZ3675000	56-49-5	N	Y	X	X			X, 71	Experimental Cancer drug				
Methyl chlorocarbonate (Carbonochloridic acid, methyl ester)	FG3675000	79-22-1	N	Y	X	X								
4,4'-Methylenebis(2-chloroaniline) (Benzenamine, 4,4'-methylenebis-(2-chloro-)	CY1050000	101-14-4	N	Y	X	X				Dye intermediate				
Methyl ethyl ketone (MEK) (2-Butanone)	EL6475000	78-93-3	N	Y	X	X	X		X, 78	Soluble in H_2O				
Methyl hydrazine (Hydrazine, methyl-)	MV5600000	60-34-4	N	Y	X			X	X, 88					
2-Methyllactonitrile (Propanenitrile, 2-hydroxy-2-methyl-)	UU9275000	75-86-5	N	Y	X	X			X, 82					
Methyl methacrylate (2-Propenoic acid, 2-methyl-, methyl ester)	OZ5075000	80-62-6	N	Y	X	X			700	Plastics & resins				
Methyl methanesulfonate (Methanesulfonic acid, methyl ester)	PB2625000	66-27-3	N	Y	X	X			X, 87	Experimental mutagenic drug				
2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) oxime (Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime)	UE2275000	116-06-3	N	Y	X	X								
N-Methyl-N'-nitro-N-nitrosoguanidine (Guanidine, N-nitroso-N-methyl-N'-nitro-)	MF4200000	70-25-7	N	Y	X	X		X						
Methyl parathion (O,O-dimethyl O-(4-nitrophenyl)phosphorothioate)	TG0175000	298-00-0	N	Y	X	X				Insecticide				
Methylthiouracil (4-1H-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-)	YR0875000	56-04-2	N	Y	X	X				Pharmaceutical				
Mustard gas (Sulfide, bis(2-chloroethyl)-)	WQ0900000	505-60-2	N	Y	X	X			X, 95					
Naphthalene	QJ0525000	91-20-3	Y	Y	X	X	X			Possibly present Sublimes	SW-846-8100 SW-846-8250 SW-846-8310			W6 1.6 1.8
1,4-Naphthoquinone (1,4-Naphthalenedione)	QL7175000	130-15-4	N	Y	X	X		X						
1-Naphthylamine (alpha-Naphthylamine)	QM1400000	134-32-7	N	Y	X	X				Dye intermediate				
2-Naphthylamine (beta-Naphthylamine)	QM2100000	91-59-8	N	Y	X	X				Dye intermediate				
1-Naphthyl-2-thiourea (Thiourea, 1-naphthalenyl-)	YT9275000	86-88-4	N	Y	X	X				Dye intermediate				
Nickel and compounds, N.O.S.	QR5950000	7440-02-0	Y	N	X	X				Naturally occurring				
Nickel carbonyl (Nickel tetracarbonyl)	QR6500000	13463-39-3	N	Y	X	X			43	Naturally occurring slightly soluble in H_2O				
Nickel cyanide (Nickel (II) cyanide)	QR6495000	557-19-7	N	Y	X	X		X		Naturally occurring slightly soluble in H_2O				
Nicotine and salts (Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)	QS5250000	54-11-5	N	Y	X	X			-151	Natural product				

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
Nitric oxide (Nitrogen (II) oxide)	QX0525000	10102-43-9	N	Y	X	X		X	X, -151					
p-Nitroaniline (Benzenamine, 4-nitro-)	BY7000000	100-01-6	N	Y	X	X				Dye intermediate				
Nitrobenzine (Benzene, nitro-)	DA6475000	98-95-3	Y	Y	X	X	X		X	Chemical intermediate	SW-846-8090 SW-846-8250			5 1.9
Nitrogen dioxide (Nitrogen (IV) oxide)	QW9800000	10102-44-0	N	Y	X	X			X, 21.2					
Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)	IA1750000	51-75-2	N	Y	X	X								
Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)	IA2200000	126-85-2	N	Y	X	X								
Nitroglycerine (1,2,3-Propanetriol, trinitrate)	QX2100000	55-63-0	N	Y	X	X		X		Explosives and pharmaceuticals				
4-Nitrophenol (Phenol, 4-nitro-)	SM2275000	100-02-7	Y	N	X	X				Chemical reagent	SW-846-8040 SW-846-8040 SW-846-8250			2.8 0.70 2.4
4-Nitroquinoline-1-oxide (Quinoline, 4-nitro-1-oxide-)	VC2100000	56-57-5	N	Y	X	X								
Nitrosamine, N.O.S.	Mixture		N	Y	X	X		X		Possibly present (trace amounts)				
N-Nitrosodi-n-butylamine (1-Butanamine, N-butyl-N-nitroso-)	EJ4025000	924-16-3	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrosodiethanolamine (Ethanol, 2,2'-(nitrosoimino)bis-)	KL9550000	1116-54-7	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrosodiethylamine (Ethanamine, N-ethyl-N-nitroso-)	JA3500000	55-18-5	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrosodimethylamine (Dimethylnitrosamine)	IQ0525000	62-75-9	Y	N	X	X				Chemical reagent (if present only in very trace amounts)	SW-846-8250			NG
N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)	YT3150000	759-73-9	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)	KR9200000	10595-95-6	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)	YT7875000	684-93-5	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)	FC6300000	615-53-2	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrosomethylvinylamine (Ethenamine, N-methyl-N-nitroso-)	YZ0875000	4549-40-0	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				

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Appendix VIII Constituents	NIOSH Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
N-Nitrosomorpholine (Morpholine, 4-nitroso-)	QE7525000	59-89-2	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrosonornicotine (Nornicotine, N-nitroso-)	QS6550000	16543-55-8	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrosopiperidine (Pyridine, hexahydro-, N-nitroso-)	TM2;00000	100-75-4	N	Y	X	X				Chemical reagent (if present only in very trace amount.)				
Nitrosopyrrolidine (Pyrrole, tetrahydro-, N-nitroso-)	UY1575000	930-55-2	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
N-Nitrososarcosine (Sarcosine, N-nitroso-)	VQ3150000	13256-22-9	N	Y	X	X				Chemical reagent (if present only in very trace amounts)				
5-Nitro-o-toluidine (Benzenamine, 2-methyl-5-nitro-)	XU8225000	99-55-8	N	Y	X	X				Dye intermediate				
Octamethylpyrophosphoramide (Diphosphoramide, octamethyl-)	UX5950000	152-16-9	N	Y	X	X								
Osmium tetroxide (Osmium (VIII) oxide)	RN1140000	20816-12-0	N	Y	X	X		X		Soluble in H_2O				
7-Oxabicyclo[2,2,1]heptane-2,3-dicarboxylic acid (Endothal)	RN7875000	145-73-3	N	Y	X	X				Plant growth regulator				
Paraldehyde (1,3,5-trioxane, 2,4,6-trimethyl-)	TE0525000	123-63-7	N	Y	X	X			124	Soluble in H_2O Organic intermediate				
Parathion (Phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl) ester	TF4550000	56-38-2	N	Y	X	X				Insecticide				
Pentachlorobenzene (Benzene, pentachloro-)	DA6400000	608-93-5	N	Y	X	X								
Pentachlorodibenzo-p-dioxins **			N	N						Possibly present				
Pentachlorodibenzofurans **			N	N						Possibly present				
Pentachloroethane (Ethane, pentachloro-)	KI6300000	76-01-7	N	Y	X	X				Oil & grease solvent				
Pentachloronitrobenzene (PCNB) (Benzene, pentachloronitro-)	DA6650000	82-68-8	N	Y	X	X				Fungicide & slimicide				
Pentachlorophenol (Phenol, pentachloro-)	SM6300000	87-86-5	Y	Y	X	X	X			Fungicide & germicide	SW-846-8040 SW-846-8040 SW-846-8250			0.74 0.59 3.6
Phenacetin (Acetamide, N-(4-ethoxyphenyl)-)	AM1375000	62-44-2	N	Y	X	X				Pharmaceutical				
Phenol (Benzene, hydroxy-)	SJ3325000	108-95-2	Y	N	X	X				Possibly present Soluble in H_2O	SW-846-8040 SW-846-8040 SW-846-8250			0.14 2.2 1.5
Phenylenediamine (Benzenediamine)	SS7700000	108-45-2	N	Y	X	X				Dye intermediate				

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Appendix VIII Constituents	RTECS Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Lim[b] (µg/kg)
Phenylmercury acetate (Mercury, acetatophenyl-)	OY6475000	62-38-4	N	Y	X	X				Fungicide				
N-Phenylthiourea (Thiourea, phenyl-)	YU1400000	103-85-5	N	Y	X	X				Pharmaceutical				
Phosgene (Carbonyl chloride)	SY5600000	75-44-5	N	Y	X	X			X	Decomposes in H_2O				
Phosphine (hydrogen phosphide)	SY7525000	7803-51-2	N	Y	X	X			X, -87.7	Slightly soluble in H_2O				
Phosphorodithioic acid, O,O-dimethyl O-[p-((dimethylamino)sulfonyl)phenyl] ester (Famphur)	TF7650000	52-85-7	N	Y	X	X				Insecticide				
Phthalic acid esters, N.O.S. (Benzene, 1,2-dicarboxylic acid, esters, N.O.S.)	Mixture		N	Y	X	X				General chemical reagent				
Phthalic anhydride (1,2-Benzenedicarboxylic acid anhydride)	TI3150000	85-44-9	N	Y	X	X				Soluble in H_2O Resin manufacturing				
2-Picoline (Pyridine, 2-methyl-)	TJ4900000	109-06-8	N	Y	X	X				Dye and resin manufacturing				
Polychlorinated biphenyl, N.O.S.	Mixture		Y	N	X	X				Electrical capacitors, hydraulic fluid, etc.	SW-846-8080			ND 0.065
Potassium cyanide	TS8750000	151-50-8	N	Y	X	X		X		Soluble in H_2O				
Potassium silver cyanide (Argentate(1-), dicyano-, potassium)	TT5775000	506-61-6	N	Y	X	X				Soluble in H_2O				
Pronamide (3,5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)	CY3460000	23950-58-5	N	Y	X	X								
1,3-Propane sultone (1,2-Oxathiolane, 2,2-dioxide)	RP5425000	1120-71-4	N	Y	X	X								
n-Propylamine (1-Propanamine)	UH9100000	107-10-8	N	Y	X	X				Intermediate lab reagent				
Propylthiouracil (Uracil, 6-methyl-2-thioxo-)	YU1400000	51-52-5	N	Y	X	X				Pharmaceutical				
Pyridine	UN9100000	110-86-1			X	X			X	Chemical synthesis				
Reserpine (Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester)	VH6825000	50-55-5	N	Y	X	X				Alkaloid Pharmaceutical				
Resorcinol (1,3-Benzenediol)	UF9625000	108-46-3	N	Y	X	X				Dye & resin manufacturing				
Saccharin and salts (1,2-benzisothiazolin-3-one, 1,1-dioxide, and salts)	DE4200000	81-07-2	N	Y	X	X				Synthetic sweetner				
Safrole (Benzene, 1,2-methylenedioxy-4-allyl-)	CY2800000	94-59-7	N	Y	X	X				Perfumes and medicines				
Selenious acid (Selenium dioxide)	VS7450000	7783-00-8	N	Y	X	X				Naturally occurring				

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Appendix VIII Constituents	RCRA Number	CAS Number	PQL Y/N	HSL[1] Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[2]	Comments	Analysis Reference	Matrix	Tech	Det Limit[3] (µg/kg)
Selenium and compounds, N.O.S.	YS*7000000	7782-49-2	N	Y	X	X	X			Naturally occurring				
Selenium sulfide (Sulfur selenide)	WT0525000	7446-34-6	N	Y	X	X				Naturally occurring				
Selenourea (Carbamimidoselenoic acid)	VU1820000	630-10-4	N	Y	X	X				Soluble in H_2O Naturally occurring				
Silver and compounds, N.O.S.	VW3500000	7440-22-4	Y	Y	X	X	X			Naturally occurring				
Silver cyanide	VW4050000	506-64-9	N	Y	X	X				Naturally occurring Slightly soluble in water				
Sodium cyanide	VZ7525000	143-33-9	N	Y	X	X		X		Ore extraction Fumigant, and soluble in H_2O				
Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)	LZ5775000	18883-66-4	N	Y	X	X				Natural product				
Strontium sulfide	WS0400000	1314-96-1	N	Y	X	X				Natural occurring and insoluble in H_2O				
Strychnine and salts (Strychnidin-10-one, and salts)	WL2275000	57-24-9	N	Y	X	X				Natural product Alkaloid				
1,2,4,5-Tetrachlorobenzene (Benzene, 1,2,4,5-tetrachloro-)	DB6450000	95-94-3	N	Y	X	X				Possibly present				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)[4]	HP3500000	1746-01-6	Y	N						Possibly present and in treated soil				
Tetrachlorodibenzofurans[4]	Mixture		N	N						Possibly present				
Tetrachlorodibenzo-p-dioxins[4]	Mixture		N							Possibly present				
Tetrachloroethane, N.O.S. (Ethane, tetrachloro-, N.O.S.)	Mixture		N	Y	X	X				Non flammable solvent				
1,1,1,2-Tetrachloroethane (Ethane, 1,1,1,2-tetrachloro-)	KI8455000	630-20-6	N	Y	X	X			130	Primarily a solvent				
1,1,2,2-Tetrachloroethane (Ethane, 1,1,2,2-tetrachloro-)	KI8575000	79-34-5	Y	Y	X	X	X		146	Primarily a solvent	SW-846-8240			6.9
Tetrachloroethylene (Ethene, 1,1,2,2-tetrachloro-)	KX3850000	127-18-4	Y	Y	X	X	X		1	Primarily a solvent	SW-846-8010 SW-846-8240			0.03 4.1
Tetrachloromethane (Carbon tetrachloride)	FG4900000	56-23-5	Y	Y	X	X	X		1.76	Primarily a solvent	SW-846-8010 SW-846-8240			0.12 2.8
2,3,4,6-Tetrachlorophenol (Phenol, 2,3,4,6-tetrachloro-)[5]	SM6275000	58-90-2	N	N	X	X				Possibly present				
Tetraethyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethyl-ester)	XM3750000	3689-24-5	N	Y	X	X				Insecticide				
Tetraethyl lead (Plumbane, tetraethyl-)	TP4550000	78-00-2	N	Y	X	X			200	Gasoline anti-knock additive				

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Appendix VIII Constituents	RTECS Number	CAS Number	PPL Y/N	HELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Limit[b] (µg/kg)
Tetraethyldithiopyrophosphate (Pyrophosphoric acid, tetraethyl ester)	UX4825000	107-49-3	N	Y	X	X				Insecticide				
Tetranitromethane (Methane, tetranitro-)	PB4025000	509-14-8	N	Y	X	X		X	126	Rocket fuel				
Thallium	XG3475000	7440-28-0	Y	Y	X	X	X			Naturally occurring				
Thallic oxide (Thallium (III) oxide)	XG2975000	1314-32-5	N	Y	X	X				Naturally occurring				
Thallium (I) acetate (Acetic acid, thallium (I) salt)	AJ8425000	563-68-8	N	Y	X	X				Naturally occurring				
Thallium (I) carbonate (Carbonic acid, dithallium (I) salt)	XG4300000	6533-73-9	N	Y	X	X				Naturally occurring				
Thallium (I) chloride	XG4200000	7791-12-0	N	Y	X	X				Naturally occurring				
Thallium (I) nitrate (Nitric acid, thallium (I) salt)	XG5950000	10102-45-1	N	Y	X	X				Naturally occurring				
Thallium selenite	XG3000000	12039-52-0	N	Y	X	X				Naturally occurring				
Thallium (I) sulfate (Sulfuric acid, thallium (I) salt)	XG4600000	10031-59-1	N	Y	X	X				Naturally occurring				
Thioacetamide (Ethanethioamide)	AC8925000	62-55-5	N	Y	X	X		X		Used in qualitative analysis				
Thiosemicarbazide (Hydrazinecarbothioamide)	VC4200000	79-19-6	N	Y	X	X				Chemical reagent, rodenticide				
Thiourea (Carbamimidothioic acid)	YU2800000	62-56-6	N	Y	X	X				Photography				
Thiram (Bis(dimethylthiocarbamoyl)disulfide) C_6-H12-N2-S4	JO1400000	137-26-8	N	Y	X	X				Vulcanizing agent for rubber				
Toluene (Benzene, methyl-)	XS5250000	108-88-3	Y	Y	X	X	X		X	Dye and chemical intermediate	SW-846-8240			6.0
Toluenediamine (Diaminotoluene)	XS9450000	25376-45-8	N	Y	X	X				Dye intermediate				
o-Toluidine hydrochloride (Benzenamine, 2-methyl-, hydrochloride)	XU4375000	95-53-4	N	Y	X	X				Dye manufacturing				
Toluene diisocyanate (Benzene, 1,3-diisocyanatomethyl-) C_9-H6-N2-O2	CZ6300000	584-84-9	N	Y	X	X				Plastics and resins				
Toxaphene (Camphene, octachloro-)	XW5250000	8001-35-2	Y	N	X	X				Insecticide	SW-846-8250			NS
Tribromomethane (Bromoform)	PB5600000	75-25-2	Y	Y	X	X	X			Organic synthesis, solvent	SW-846-8240			4.7
1,2,4-Trichlorobenzene (Benzene, 1,2,4-trichloro-)	DC2100000	120-82-1	Y	Y	X	X	X			Chemical intermediate Lubricant	SW-846-8120 SW-846-8250			0.05 1.9
1,1,1-Trichloroethane (Methyl chloroform)	KJ2750000	71-55-6	Y	Y	X	X	X		X, PS	Solvent	SW-846-8010 SW-846-8240			0.03 3.8
1,1,2-Trichloroethane (Ethane, 1,1,2-trichloro-)	KU3150000	79-00-5	Y	Y	X	X	X		X	Solvent	SW-846-8010 SW-846-8240			0.07 5.0
Trichloroethene (Trichloroethylene)	KX4550000	79-01-6	Y	Y	X	X	X		X	Solvent	SW-846-8010 SW-846-8240			0.12 1.9

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Appendix VIII Constituent	RTECS Number	CAS Number	PPL Y/N	DELIST Y/N	Reason Not Expected	No History	Not Found	Unstable	Volatile[a]	Comments	Analysis Reference	Matrix	Tech	Det Lim[b] (µg/kg)
Trichloromethanethiol (Methanethiol, trichloro-)			N	Y	X	X			X					
Trichloromonofluoromethane (Methane, trichlorofluoro-)	PA6175000	75-69-4	N	Y	X	X			X	Solvent Fire extinguisher				
2,4,5-Trichlorophenol (Phenol, 2,4,5-trichloro-)[cc]	SL1400000	95-95-4	N	Y	X	X				Possibly present				
2,4,6-Trichlorophenol (Phenol, 2,4,6-trichloro-)	SM1575000	88-06-2	Y	N	X	X			X	Possibly present	SW-846-8040 SW-846-8250			0.64 7.7
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid, 2,4,5-trichlorophenoxy-)	AJ8400000	93-76-5	N	N						Possibly present	SW-846-8150			0.1
2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex) (Propionic acid, 2-(2,4,5-trichlorophenoxy)-)	UF8275000	93-72-1	N	Y	X	X				Possibly present				
Trichloropropane, N.O.S. (Propane, trichloro-, N.O.S.)			N	Y	X	X			X	Degreaser				
1,2,3-Trichloropropane (Propane, 1,2,3-trichloro-)	TZ9275000	96-18-4	N	Y	X	X			X	Degreaser				
O,O,O-Triethyl phosphorothioate (Phosphorothioic acid, O,O,O-triethyl ester)	TG3675000	126-68-1	N	Y	X	X				Plasticizer, hydraulic fluid				
sym-Trinitrobenzene (Benzene, 1,3,5-trinitro-)	DC3850000	99-35-4	N	Y	X	X		X		Explosive				
Tris(1-aziridinyl)phosphine sulfide (Phosphine sulfide, tris(1-aziridinyl-)	TF2975000	52-24-4	N	Y	X	X				Insect sterilant				
Tris(2,3-dibromopropyl)phosphate (1-Propanol, 2,3-dibromo-, phosphate)	UB0350000	126-72-7	N	Y	X	X				Flame retardant for plastic				
Trypan blue (2,7-Naphthalenedisulfonic acid,	QJ6475000	72-57-1	N	Y	X	X				Biological stain				
3,3'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)] bis(5-amino-4-hydroxy-, tetrasodium salt)			N	Y	X	X								
Uracil mustard (uracil 5-[bis(2-chloroethyl)amino]-)	YQ8975000	66-75-1	N	Y	X	X								
Vanadic acid, ammonium salt (ammonium vanadate)	YW4575000	7803-55-6	N	Y	X	X				Slightly soluble in H_2O Naturally occurring				
Vanadium pentoxide (Vanadium (V) oxide)	YW2450000	1314-62-1	N	Y	X	X				Naturally occurring				
Vinyl chloride (Ethene, chloro-)	KU9625000	75-01-4	Y	Y	X	X	X		X	Polymer manufacturing	SW-846-8010 SW-846-8040			0.18 NS
Zinc cyanide	ZH1575000	557-21-1	N	Y	Z	X		X		Water soluble				
Zinc phosphide	ZH0900000	1314-84-7	N	Y	X	X		X	RP420	Flammable solid				

[a]Boiling point in °C, unless noted with M for melting point.

[b]Detection limits:
-apply to liquids (detection limits for solids may be considerably higher).
-where 2 different detection limits are listed for the same analytical method, the detection limits are for different detectors (e.g., Flame Ionization Detector, Electron Capture Detector, etc.).
NS = not given.

[c]2,4 D or 2,4,5 T.

[dd]Polychlorinated dibenzodioxins or polychlorinated dibenzofurans.

[ee]Other category of interest.

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APPENDIX F

DETAILED DESCRIPTION OF ENSCO MWP-2000 INCINERATOR SYSTEM

APPENDIX F

DETAILED DESCRIPTION OF ENSCO MWP-2000 INCINERATOR SYSTEM

A. GENERAL DESCRIPTION

The ENSCO incinerator (Mobile Waste Processor-MWP-2000) was designed and fabricated by ENSCO at the White Bluff, Tennessee, manufacturing facility. The MWP-2000 incinerator is a modular system designed to destroy and detoxify solid, semi-solid, and/or liquid wastes. Most of the components of the system are installed on trailers, platforms or skids to facilitate the movement of the system from location to location to perform on-site cleanup of contaminated sites.

The flow schematic of the system is shown in Figure F-1. Principal components of the unit are:

- Waste feed system
- Rotary kiln with outlet cyclones
- Secondary combustion chamber (SCC)
- Air pollution control train consisting of
  - Effluent neutralization unit
  - Packed tower
  - Ejector scrubber, demister, and stack.

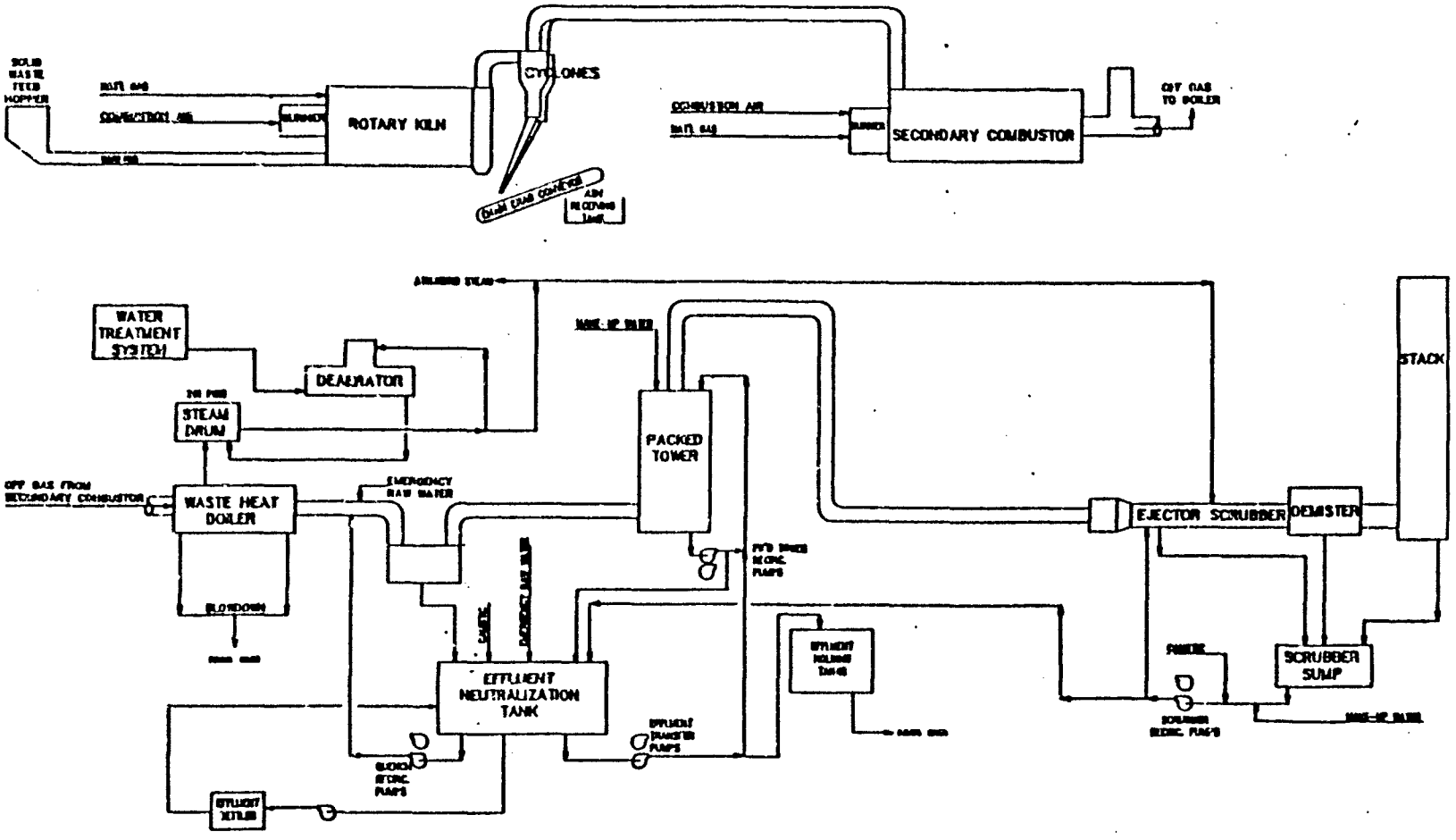

Figure F-1. Schematic flow diagram of MWP-2000 incinerator system.

The auxiliary components of the unit are:

- Waste heat boiler and steam drum.
- Boiler water treatment unit.
- Ash removal unit.
- Effluent settling unit.
- Effluent holding tanks.

After soil has been excavated, it is placed in soil handling bins which have a capacity of approximately 20 cubic yards. The soil is then transferred, as required, to a soil feed conveyor which feeds the soil hopper. An in-line weight scale is used to determine the quantity of soil fed to the system.

The soil is then fed to the kiln where it is exposed to temperatures in the 1200 to 1600°F range. Natural gas is used as the fuel to maintain the temperature in the kiln. The soil and exhaust gases exit from the kiln and the treated soil falls into an ash quench. An ash drag conveyor is used to remove the soil from the ash quench and transport it to the ash bin.

As the exhaust gases exit the kiln, they pass through a cyclone for the removal of fine particulate. The gases then flow into the SCC where the temperature of the gas is raised to 2100-2200°F. The gas enters a waste heat boiler downstream of the SCC where steam is generated for use in the facility.

Prior to entering a scrubber, the gases flow into an elbow where it is water quenched to reduce the gas temperature so that the fiber glass reinforced plastic scrubber is not damaged. The scrubber uses water as a scrubbing media to remove any fine particulate and acid gases that may be present. The gas then exists the process through a demister and on through the stack.

A detailed description of the different components of the MWP-2000 incinerator system follow in the remainder of this appendix.

B. WASTE FEED SYSTEM

The waste feed system consists of a weigh hopper/shredder unit, conveyor, and feed hopper/auger unit. The weigh hopper/shredder unit receives excavated soils, records the total weight of the soil, and then crushes it into approximately two inch chunks for conveyance to the feed hopper by conveyor. The conveyor is covered belt type conveyor that delivers prepared soil to the feed hopper for introduction into the kiln. The feed hopper receives the crushed material from the conveyor and funnels it into a screw auger for introduction into the kiln. The feed hopper is totally enclosed and has hinged access doors. The effective capacity of the feed hopper is 1 cubic yard. The feed auger is a 12 inch diameter screw with flights at a 6 inch pitch in the feed section. The auger is inclined into the kiln for ease of feed.

The feed auger has a variable speed control which is used to determine the feed rate to the kiln. The kiln feed rate is a function of:

1. Auger speed.

2. Bulk density of the solid waste to be incinerated, including:

    a. Type of waste and its composition.

    b. Moisture content of the waste.

3. Percentage of loading in the auger flights.

The bulk density of the waste is determined analytically prior to a trial burn for sand and has been determined for the native soils at the NCBC. However, the determination of the percentage of auger flight loading does require field observation and development of feed curves. This can be done

during a clean soil test. The auger rotational speed is interlocked with a setpoint maximum speed; the setpoint for the interlock is determined based on the feed rate dependencies just discussed and any permit-specified limits.

C. ROTARY KILN

The rotary kiln is primarily designed to burn or detoxify hazardous waste. Detoxification occurs by thermal desorption of organics from the solid waste. Due to the high temperatures, however, the kiln will combust and destroy some of those desorbed organics. Additionally, waste water and other liquid materials can be processed by injection through nozzles located near the burner. This option, however, was not used during this demonstration project.

1. Configuration and Materials

The rotary kiln is a 0.5 inch thick carbon steel cylinder mounted horizontally on a carbon steel support beam construction custom trailer and is lined with 6 inches of high alumina fire brick. The resulting interior dimensions are:

Kiln ID	- 5.5 feet
Kiln length	- 30.0 feet
Effective volume	- 697 cubic feet

The kiln is mounted so that it is inclined 2 degrees, and is rotated by a hydraulically powered gear trunnion mechanism that can rotate the kiln from 0.5 to 4.0 revolutions/minute. The waste feed system and the burner system are located at the higher end of the kiln while the gas outlet and ash drop are located at the opposite, lower end.

2. Burner and Nozzle Design

The kiln is equipped with a single burner that is capable of producing approximately 14 million Btu/hour of heat and outlet gas

temperatures up to 1800°F when using natural gas. Typically, the kiln will be operated at a stoichiometry of 1.1 to 1.5. The solids residence time will vary with the rate and type of wastes being fed and can be varied by changing the feed auger speed. The usual solids retention time in the kiln is 30 to 60 minutes. The burner produces a long flame cone up to 15 feet long and 3.5 feet in diameter at the end of the flame cone. The burner is designed to handle dirty fuel or wastes having particle sizes up to 0.125 inch; however, this option was not utilized at the NCBC because natural gas was the only fuel used.

The burner is served by a flame supervisor which manages the lighting of a pilot flame and the full flame. When lighting the pilot flame, the supervisor controls the introduction of propane or natural gas and the ignition spark is in a time sequential manner. When lighting the full flame, this supervisor controls the introduction of clean fuel when the pilot flame is lit and stable. The flame supervisor also controls the shutoff of waste or clean fuel to the burner if the upset conditions occur.

3. Cyclones

A pair of cyclones are installed, in parallel, in the duct work between the kiln and the SCC to remove lighter particulate that does not fall out in the kiln ash removal system. These solids would otherwise carry over into the SCC when soil or other fine-grained inorganic solids are being burned in the kiln. The cyclones are lined with 4 inches of castable refractory. Only one of the two cyclones is used when processing soils at the NCBC so that increased flow rate would ensure greater separation of the particulates from the gas stream. Isolation of the second cyclone is accomplished by inserting a flat-type gate in the ducting at the top of the cyclones.

Outlet gases from the kiln pass through the cyclones in a vortex flow pattern and then into the outlet duct work for conveyance to the secondary combustor. Particulate removed from the gases by the vortex flow pattern falls to the bottom of the cyclones and flows by gravity into the

ash receiving tank of the ash removal unit. The water contained within the ash removal unit quenches the hot particulate solids and serves as a liquid seal between the kiln, cyclone duct work, and the transition duct work to the SCC.

D. SECONDARY COMBUSTION CHAMBER

The SCC is designed to ensure complete combustion of the gases discharged from the rotary kiln. The SCC is capable of burning waste liquids injected through an injection nozzle; however, this option was not used during the verification test burns.

1. Configuration and Materials

The SCC is a 0.5 inch thick carbon steel cylinder, approximately 40 feet long, and mounted horizontally on two carbon steel supports on a flat bed trailer. The shell is lined with 2.25 inches of insulating brick and 4.5 inches of fire brick. The resulting interior dimensions are:

Secondary ID - 79.5 inches
Secondary length - 40.0 feet
Effective volume - 1377 cubic feet

Gases from the cyclone are delivered to the SCC through a rectangular carbon steel duct lined with 4 inches of castable refractory. The duct introduces gases into the SCC tangentially through a 1.75 feet x 3.50 feet rectangular port on the upper right side of the inlet end of the secondary.

2. Burner and Nozzle Design

The SCC is equipped with a vortex burner which is capable of producing approximately 24 million Btu/hour of heat with an upper range outlet gas temperature of 2100 to 2400°F using natural gas or other fuels having heating values from 6000 to 19500 BTU/pound. Typically it will be operated at a stoichiometry of 1.2 to 1.5.

The burner nozzle is designed to concurrently introduce fuels, natural gas, and/or atomizing steam or air and is fabricated with a specialized tip for handling highly chlorinated liquid wastes. The burner produces a short (4 foot), highly turbulent flame cone. Combustion air is introduced into the burner tangentially to the create a turbulent flame. The combustion air is supplied by a blower capable of delivering 5460 cfm at 35 inches wc pressure. The burner is served by a flame supervisor that manages the lighting of the pilot and full flame and controls the shutoff of natural gas to the burner in upset conditions.

3. Exit Zone

Gases exit the SCC and are carried to the waste heat boiler through a carbon steel T-section duct lined with 4 inches of castable refractory resulting in a 46 inch ID. The vertical leg of this T-section duct is equipped with an access lid that acts as a thermal relief valve (TRV), which can be opened to vent hot gases away from the boiler and the downstream air pollution control train in event of an emergency.

Opening the TRV is a manual operation. Either one of the following sustained conditions will cause the technician to open the TRV:

(1) Low-Low Steam Drum Level--A low level in the steam drum automatically operates the automatic waste feed shutoff (AWFSO) circuit to stop waste feed to the kiln. Thus, prior to the actuation of a low-low alarm in the steam drum, the waste feed to the kiln has been stopped.

(2) High-High Packed Tower Inlet Temperature--A high packed tower temperature automatically opens the emergency quench water valve into the quench elbow. A high packed tower temperature automatically operates the AWFSO circuit to stop waste feed to the kiln. Thus, prior to reaching the conditions which would cause an operator to open the TRV, the waste feed to the kiln has been stopped.

The TRV is in itself linked to the AWFSO system so that if it is opened the waste feed is automatically stopped. The TRV may be opened during cooldown of the incinerator. However, it is only opened after all waste in the kiln is completely processed. To accomplish that, the operators stops the waste feed and continues to operate the incinerator in a normal mode for a minimum of 20 minutes to ensure all waste in the kiln is processed. Only after that period will the TRV be opened to facilitate a normal cooldown of the system.

4. Removal Chute

The secondary combustor is equipped with four solids removal chutes to facilitate the removal of any solids during operations which were not removed by the cyclones and are carried over into and drop out in the SCC. Each chute is fabricated of carbon steel, is lined with 2 inches of castable refractory, and has inlet dimensions of 10 inches by 14 inches. Steam lines can be connected to the discharge end of each chute to supply steam to draw solids from the chute and convey them to a solids collection bin. Alternatively, slide gates can be installed in the chutes to control the discharge of solids into underlying collection bins. Selection of either of these options is based on the physical properties of the solids collected in the SCC.

E. AIR POLLUTION CONTROL TRAIN

The air pollution control train consists of a quench and effluent neutralization unit, packed tower, ejector scrubber, and stack. This equipment train is designed to cool and remove acid and submicron particulate from the gases that exit the waste heat boiler and to neutralize the effluent generated in this train. The quench system and packed tower are installed on a skid which is located adjacent to the flatbed trailer that holds the waste heat boiler. The effluent neutralization tank (ENT) is located on a skid adjacent to the packed tower. The scrubber, demister, and stack are mounted on a flatbed trailer.

The major material of the effluent neutralization system is carbon steel plate. The major material of the packed tower and the ejector scrubber is fiber glass reinforced plastic.

1. Quench and Effluent Neutralization Unit

The quench and effluent neutralization unit consists of a vertical 90 degree reducing quench elbow, packed tower inlet duct, and effluent neutralization tank. The duct work conveys exit gases from the waste heat boiler to the quench elbow, past the neutralization tank to the packed tower.

The quench elbow contains several nozzles which spray recirculated water from the effluent neutralization tank into the elbow to cool and partially remove acid from the gases that exit from the waste heat boiler. Gas temperatures are reduced from approximately 800°F to approximately 165°F. The quench elbow is fabricated of Inconel.

The neutralization tank collects the recirculated water sprayed into the quench elbow (less that portion evaporated). The packed tower inlet duct conveys gases from the quench elbow to the packed tower. Collected water is drained from the packed tower inlet duct by gravity to the ENT. The packed tower inlet duct is fabricated of fiber glass reinforced plastic.

The quench elbow is served by a recirculation line with a pair of pumps (one of which serves as a standby) which recirculate water from the ENT to the spray nozzles in the quench elbow. This recirculation line is equipped with a flow meter which transmits to an indicator on the operator control panel and the data acquisition and control computer. The line is also equipped with (1) a strainer, (2) a low pressure switch which transmits to an alarm on the control panel, (3) a pH measuring device that transmits to a controller that controls the injection of caustic into the neutralization tank, (4) pressure gages with local readouts, and (5) appropriate valving.

The quench elbow is also served by an emergency raw water line which will introduce cooling water to a spray nozzle in the quench elbow if the recirculation of water from the ENT is not sufficiently cooling the gases passing through the quench zone. The introduction of raw water is ordered by a high temperature switch activated by a thermocouple in the outlet duct of the quench zone. This high temperature switch actuates a pneumatic solenoid valve which in turn actuates a valve on the emergency raw water line. The solenoid valve also can be manually operated. The emergency raw water line is equipped with appropriate valving.

Inlet gas temperatures to the quench zone and packed tower are measured by redundant thermocouples in the outlet duct. One thermocouple transmits to a digital indicator on the control panel. The other thermocouple transmits to: (1) the data acquisition and control computer which displays readings on the monitor, (2) the high temperature switch that controls the introduction of emergency raw water to the quench elbow, and (3) the high-high temperature switch shutoff to the kiln burner and secondary combustion chamber burner fuel and activates the AWFSO circuits.

Outlet vacuum from the quench zone is measured by a draft transmitter in the outlet duct. Measurements are transmitted to an indicator on the control panel and to the data acquisition and control computer, and also to the AWFSO circuit. Outlet vacuum is also measured by a pressure gage (with local readout) on the outlet duct.

2. Packed Tower

The packed tower is designed to remove additional acid from the gases that exit the quench zone. The gases flow upward through the tower and are scrubbed by a countercurrent flow of water sprayed into the top of the tower. Scrubbing water is introduced through individual spray nozzles from three sources: (1) fresh water makeup, and (2) excess water from the scrubber sump, and (3) fresh water recirculated from the packed tower sump and the ENT. The capabilities exist to inject caustic into the recirculation lines in order to scrub sulfuric acid out of the gas if high

sulfur wastes are being burned. Excess water collected in the sump of the packed tower (that water which is not recirculated to the top of the tower) is pumped to the ENT.

The packed tower is 14 feet high and 6 feet in diameter, and is fabricated of fiber glass reinforced plastic. It is filled to a depth of approximately 6 feet with 2 inch diameter plastic packing material. A demister pad is installed above the packing. The tower is capable of receiving an additional 6 feet of packing material if the projected chlorine loading indicates it would be necessary. This option, however, was not used during the NCBC verification test burns.

The packed tower is served by: (1) a fresh makeup water line, (2) a recirculation line from the packed tower sump, and (3) a transfer line from the effluent neutralization tank. The fresh water makeup line is equipped with a flow meter which transmits to an indicator on the control panel and the data acquisition and control computer. The flow of fresh water makeup to the packed tower is controlled by a manual valve. Parallel with this meter is an automatic emergency water valve which is activated by a low level water switch in the packed tower sump.

The recirculation line from the packed tower sump is equipped with two pumps (one as an in-line spare) which deliver sump water for both recirculation and purge (excess sump water) to the effluent neutralization tank. This line also is equipped with a flow meter which measures the combined flow of water recirculated from the packed tower sump and the ENT. This meter transmits to an indicator on the control panel and to the data acquisition and control computer. Recirculation flow is controlled by a manually set valve on the recirculation line.

The recirculation line from the effluent neutralization tank is equipped with two pumps (one as an in-line spare) which deliver water from the tank for both recirculation and purge to the effluent holding tanks. This line also is equipped with a magnetic flow meter which transmits to an

indicator on the control panel and to the data acquisition and control computer. Recirculation flow is controlled by a manually set valve on the recirculation line.

The packed tower is served by a purge line to pump excess water from the packed tower sump to the ENT. This line is equipped with a pneumatically operated valve which is designed to fail open. The referenced valve is controlled by a level indicating controller which receives a signal from a transmitter that reads water levels in the packed tower sump.

Inlet gas temperatures to the packed tower are measured by the previously described thermocouples that measure outlet gas temperatures from the ENT.

Vacuum at the outlet of the packed tower is measured by a draft transmitter in the outlet duct which transmits to an indicator on the control panel and the data acquisition and control computer. Outlet vacuum is also redundantly measured by a vacuum gage (with a local readout) on the outlet duct.

3. Ejector Scrubber and Demister

The ejector scrubber is designed to remove submicron particulate and additional acid from the gases before they are discharged through the demister and the stack. Gases exiting the packed tower are drawn through the ejector mixing tube by the force of steam delivered through a nozzle in the mixing tube. The turbulence created by the unique nozzle and mixing tube design causes the agglomeration of submicron particulate and the absorption of acid in the water vapor supplied by the steam. This material is removed by the removal of water vapor in the demister at the downstream end of the scrubber.

The ejector scrubber also serves as the prime mover for the entire system. The drawing of gases through the ejector mixing tube, a single steam powered jet venturi manufactured by Hydrosonics, Inc., produces up to

25 inches WC vacuum. This is sufficient vacuum to draw gases through the rotary kiln, secondary combustor, waste heat boiler, and the air pollution control train.

All the structural components of the ejector scrubber are fabricated of fiber glass reinforced plastic.

Condensate formed and removed in the ejector scrubber and demister drains by gravity into the scrubber sump. The condensate that falls out in the stack drains by gravity into the scrubber sump and the scrubber water is recirculated to the ejector scrubber. Excess scrubber water is purged to the packed tower.

Provision is made for injecting caustic into the recirculation line from the scrubber sump to the ejector scrubber to augment the acid removal capacity of the ejector scrubber when needed. While this capability was in place at the NCBC site, the option was not used.

The ejector scrubber is served by a fresh water makeup line which introduces makeup water into the recirculation line from the scrubber sump to the ejector scrubber spray nozzle. The makeup water is introduced through a control valve and a flow indicating controller which are delineated below. Overriding actuation of this control valve is also provided by a solenoid valve which is activated by a high water level switch on the scrubber sump to close the control valve when high water level is detected in the sump. Additional makeup water flow can be provided through a by-pass loop which is controlled by a control valve activated by the low water level switch on the scrubber sump. The fresh water makeup line also is equipped with: (1) a pressure gage with local readout, and (2) a flow meter that transmits to the aforementioned flow indicating controller and the data acquisition and control computer.

The scrubber sump is equipped with a water level transmitter that transmits to the level indicating controller that actuates the control valve on the scrubber sump purge line as described above. The sump is also

equipped with high water level and low water level switches. The high water level switch transmits to an alarm on the control panel and to the solenoid valve that actuates shutoff of flow of emergency water to the scrubber sump as described above. The low water level switch transmits to an alarm on the operator control panel and the solenoid valve that orders additional flow of emergency water to the scrubber sump as described above. Finally, the scrubber sump is equipped with a sight glass to enable visual observation of water level in the sump.

Inlet gas temperature to the ejector scrubber is measured by a thermocouple which transmits to a digital indicator on the operator control panel and the data acquisition and control computer. Outlet gas temperature from the demister is measured in the same manner. Vacuum in the ejector scrubber is measured by a draft transmitter that transmits to an indicator on the operator control panel and the data acquisition and control computer.

The ejector scrubber is served by a steam supply line that delivers steam from the waste heat boiler to the scrubber jet. This line is equipped with a control valve which is controlled by a pressure indicating controller to maintain a selected delivery pressure to the jet, and is designed to fail closed. A pressure transmitter in the steam supply line transmits to the pressure indicating controller and to the data acquisition and control computer. The steam supply line is also equipped with: (1) a low pressure switch that transmits to an alarm on the control panel, (2) a pressure gage with a local readout, and (3) a thermocouple that transmits to a digital readout indicator on the operator control panel and the data acquisition and control computer.

The ejector scrubber is served by a recirculation line to recirculate water from the scrubber sump to the scrubber spray nozzle. This line is equipped with two pumps (one in-line spare) and a flow meter which transmits to an indicator on the control panel and the data acquisition and control computer. The line is also equipped with: (1) a low pressure switch that transmits to an alarm on the control panel, (2) pressure gages

with local readouts, (3) a pH measurement instrument which transmits a signal to the data acquisition and control computer, (4) check valves, (5) strainers, and (6) appropriate manually operated valves.

The recirculation line also delivers excess scrubber sump water to a purge line which conveys this excess water to the effluent neutralization tank. The purge line is equipped with a control valve that is activated by a level indicating controller which receives signals from a water level transmitter on the scrubber sump. The recirculation line is served by a caustic injection line to enable the supply of caustic to the ejector scrubber, when necessary, to augment acid removal and achieve free chlorine removal. This injection line is equipped with: (1) two pumps, one of which is an in-line spare, (2) appropriate valving, and (3) a control valve which is controlled by the instrumentation that measures the pH of the stack condensate [see description in the following subsection]. The instrumentation consists of a pH probe and an indicating transmitter which transmits to the controller that governs caustic injection and to the data acquisition and control computer. Pressure differential across the demister is measured by a differential pressure transmitter which transmits to the data acquisition and control computer.

4. Stack and Gas Monitoring

The stack is fabricated of fiber glass reinforced plastic and rises approximately 30 feet from the trailer bed and approximately 41 feet from ground level. The stack is equipped with sampling ports and an access platform to these ports to facilitate sampling during demonstration tests. It has three sections.

Section	Inside Diameter (inches)	Section Height (feet-inches)
Lower	36	8-10
Reducer	36 to 30	13-6
Upper	30	13-6
		13-6

a. On-line Gas Monitors

The stack is equipped with a gas sampling unit that collects, conditions, and delivers a continuous stack sample stream to oxygen, carbon monoxide, and carbon dioxide monitors located in the control room trailer for the MWP-2000 incinerator system. These monitors continuously analyze the sample stream and transmit the concentration results to the data acquisition and control computer. The purpose of this extractive continuous emission monitoring (ECEM) is to provide data to: (1) demonstrate compliance with authorized operating conditions and, (2) evaluate the operation of the system. The combustion efficiency and secondary combustor gas residence times are calculated by the data acquisition and control computer. Additionally, the oxygen, carbon monoxide, and carbon dioxide analyzers transmit results to strip chart recorders to provide a redundant recording of these parameters. The oxygen and carbon monoxide analyzers also transmit to alarms on the control panel (a low level alarm for oxygen and a high level alarm for carbon monoxide) and to the AWFSO circuit.

The oxygen monitor was manufactured by Teledyne Analytical Instruments and utilizes a unique microfuel cell to measure the concentration of oxygen in a gas stream. The analysis is specific for oxygen (the measuring cell will not generate an output current unless oxygen is present in the sample gas). The measuring cell has the ability of accurately responding to the presence of oxygen irrespective of flow rate. The monitor can be calibrated using atmospheric air as a span gas. Oxygen is consumed by the cell from the gas around it, and a proportionatemicroampere current generated. The low level signal is then amplified by a solid-state integrated circuit amplifier and the resulting signal is sent to a recorder, a temperature compensator circuit, and an integral microampere meter.

The carbon monoxide monitor (Model 865) was manufactured by Beckman Instruments. The CO monitor produces infrared radiation from two separate sources and beams these separate streams through a chopper which

interrupts it at 10 Hz. The detector is a "gas microphone" on the Luft principle. It converts the difference in energy as a capacitance change which is amplified and then indicated on a meter used to drive a recorder.

The carbon dioxide monitor was manufactured by Infrared Industries and is a nondispersive infrared gas analyzer which is capable of continuously monitoring the CO_2 content of a gas stream.

Calibration of the monitors is accomplished by injecting the gas from the control room (trailer) through a 0.25 inch PVC line to the stack where the gas sample probe is installed. All calibration gas, listed below, is traceable to the National Bureau of Standards.

		Calibration Gas		
Monitor	Range	N_2 Low	Mid	High
O_2	0 - 25%	0%	10%	20.9%
CO	0 - 100%	0%	50 ppm	99.8 ppm
CO_2	0 - 50%	0%	25%	49.9%

The calibration procedure is normally performed at the start of each shift. This procedure ensures a check on all gas interlocks, response time of the system and provides a leak check for the gas sampling system. Each gas monitor is given a three point calibration as per the table above.

The combustion efficiency being achieved by the MWP-2000 incinerator system is continuously calculated by the data acquisition and control computer from readings from the carbon dioxide and carbon monoxide monitors. This calculation is performed using the equation:

$$\text{Percent combustion efficiency} = \frac{(CO_2)}{(CO_2 + CO)} \times 100$$

where:

(CO_2) = the reading from the carbon dioxide monitor converted to ppm,

(CO) = the reading from the carbon monoxide monitor in ppm.

This calculation is recorded in the data acquisition and control computer. If the computer malfunctions making this calculation, waste feed to the system is shut off until the malfunction is corrected.

b. Other Sensors

Stack outlet gas temperature is measured by a thermocouple that transmits to an indicator on the operator control panel and to the data acquisition and control computer.

Stack condensate is continuously sampled and analyzed for pH by a probe assembly and analyzer on the stack. Measurements of pH are transmitted to the pH indicator controller which controls the injection of caustic into the ejector scrubber recirculation line. These parameters are monitored by the data acquisition and control computer.

F. AUXILIARY COMPONENTS

1. Waste Heat Boiler and Steam Drum

The waste heat boiler is a fire tube boiler and is designed to recover heat from the gases that exit the secondary combustor and produce steam at 250 psig, which is supplied to the ejector scrubber and deaerator. Steam is also available to the kiln and secondary burner nozzles for the atomization of waste fuels, but this option was not used at the NCBC site during the verification test burns. The boiler is rated at 19.6 million Btu/hour. It is designed to be operated so that tube metal temperatures are maintained above 400°F to avoid acid corrosion. It also is designed to maintain high gas velocities through the boiler tubes in an attempt to avoid

fouling of the tubes by particulate deposits. A simplified schematic for the waste heat boiler is shown in Figure 14. The boiler is located on a flatbed trailer along with the deaerator.

On the NCBC project, the T-section duct connecting the SCC to the boiler was equipped with water sprays to partially cool the gases flowing into the boiler. The purpose of this water spray was to cool and condense the low melting-point particulate entrained in the gases. This action prevents their condensation on the face plate and in the tubes of the boiler.

Gas inlet temperatures to the boiler are determined by thermocouple instrumentation that measure the gas outlet temperature from the secondary combustion chamber. Gas outlet temperatures from the boiler are measured by the thermocouple instrumentation that measures the inlet gas temperature to the quench elbow.

Boiler outlet vacuum is measured by a draft transmitter in the outlet duct transmits to an indicator on the control panel and to the data acquisition and control computer. Vacuum is also redundantly measured by a vacuum gage with a local readout on the outlet duct. The boiler is equipped with blowdown lines which are fed to a blowdown tank which then gravity feeds to the publicly owned treatment works (POTW) sewer. The boiler blowdown water does not come into contact with any process gases or contaminates. Therefore, no hazardous constituents could be discharged to the POTW via the boiler blowdown.

Steam produced by the boiler is supplied from the steam drum to its several uses through the steam header. The header is equipped with a vent and a pressure measuring device which transmits to a (1) a pressure indicating controller that operates a control valve on the vent, and (2) the data acquisition and control computer.

The steam drum is served by a makeup water feed line. Make-up water flow into the drum is controlled by a control valve which is actuated by a controller that operates due to signals received from the water level transmitter on the steam drum. This line is equipped with a flow meter

which transmits to an indicator on the control panel and to the data acquisition and control computer. The steam drum is equipped with a thermocouple that transmits to an indicator on the control panel and to the data acquisition and control computer. Further, the drum is equipped with: (1) a water level transmitter that transmits to the controller that governs the introduction of makeup water to the drum and transmits to the data acquisition and control computer, and (2) high, low and low-low water level switches. Each of these switches operates an alarm on the control panel and the low and low-low water level switch connect to the AWFSO circuit. Finally, the steam drum is equipped with a vent, two pressure relief valves, a pressure gage (with local readout), and blowdown line.

2. Boiler Water Treatment Units

The boiler water feed pump skid consists of two boiler water feed pumps (one of which is an in-line spare) and a chemical injection system which supplies boiler chemicals to the system as specified by the boiler water treatment program. The pumps deliver treated water to the steam drum and the system is designed to produce approximately 50 gpm of zero-hardness water. The NCBC project also included a commercial unit to remove silica from the raw water that is present in the base water supply.

3. Ash Removal Unit

Ash and solids from the rotary kiln are discharged into a water sealed breeching at the lower end of the kiln. These materials fall from this breeching into an ash receiving tank that is filled with water above the discharge lip of the breeching to provide a water seal. Solids removed by the cyclones are also discharged into the ash receiving tank. Ash and solids are removed from the ash receiving tank by a chain drag conveyor and discharged into rolloff boxes for further ash handling.

4. Effluent Settling Unit

The effluent settling unit is a sealed rolloff box into which the settled solids from the ENT are pumped as a slurry for further settling.

The supernatant water is returned to the ENT, and the settled solids are sampled and analyzed for the POHCs. These solids are held in a sealed rolloff bin until analysis shows that they are free of POHC.

5. Effluent Holding Tanks

The NCBC project configuration includes two effluent holding tanks into which all excess water from the ENT, ash removal unit, and effluent settling unit are pumped. This excess liquid receives activated carbon treatment prior to routing to either tank. Following analytical procedures, the stored liquids can be gravity drained to the POTW sewer.

G. AUXILIARY FUEL FEED

The fuel used for the NCBC project was exclusively natural gas. The fuel was delivered to the MWP-2000 incinerator system through a four inch header pipeline that was fed directly off the base main supply line. The gas is metered and there are two points for emergency shutoff on the fuel supply header feeding the MWP-2000 incinerator system. The natural gas flow rate to the kiln and secondary burners is indicated in the control room trailer and is also displayed and totalized in the data acquisition and control computer.

The natural gas supply lines to both burners are equipped with two redundant shutoff valves and a vent valve between the two shutoff valves. These valves, in this double block and bleed arrangement, are controlled by the kiln and secondary combustor flame supervisors which: (1) permits feeding natural gas to the burner when flame is present, and (2) shutoff of the natural gas feed when upset conditions occur. High pressure and low pressure in the natural gas header will shut off natural gas feed to the burners.

H. AUTOMATIC WASTE FEED SHUTOFF CIRCUIT

The control trailer/motor control center houses the automatic waste feed shutoff (AWFSO) circuit and the flame supervision systems servicing

the kiln burner and the SCC burner. Each of the referenced burners are controlled by an independent flame supervisor. These interconnected circuits are configured to handle the upset conditions detailed below.

1. Low Temperature in the Secondary Combustion Chamber

When the SCC outlet gas temperature falls below 2150°F, the waste feed to the kiln is shut off, and an audible alarm is sounded on the control panel. These functions are performed by the AWFSO circuit.

For the low temperature condition being, discussed, the AWFSO circuit is activated by one of the thermocouples in the outlet duct of the SCC. The low temperature switch, to which the thermocouple failure (open circuit) will cause the switch to drive to zero degrees which activates the AWFSO, which shuts off the waste feed. There are redundant thermocouples located in the SCC which transmit a redundant signal to separate indicators in the control room trailer and to the data acquisition and control computer, which also operates the AWFSO circuits.

2. Low Oxygen in Stack

When stack gas oxygen concentration falls below 3 percent, all waste feed to the kiln is switched off. Because the NCBC project involved only solid waste feed, both the kiln and secondary burners used only natural gas feed. An audible alarm sounds on the control panel and the AWFSO circuit shuts off the hydraulic drive for the kiln auger feed. The AWFSO is activated by a signal from the oxygen monitor.

3. Low Combustion Efficiency, High CO in the Stack Gas

When combustion efficiency falls below 99.9 percent, waste feed to the kiln is switched off by the AWFSO circuit in the same manner described for the previous event. An audible alarm also sounds on the control panel.

The AWFSO circuit is activated by the data acquisition and control computer which calculates combustion efficiency from carbon monoxide and carbon dioxide concentration results received from the CO and CO_2 stack gas monitors.

As a backup (when carbon monoxide concentrations in the stack gases exceed 50 ppm), the shutoff of waste feed is activated as described above. These functions are also performed by the AWFSO circuit when it is activated by a signal from the carbon monoxide monitor.

4. Loss of Kiln Burner Flame, Loss of Kiln Burner Combustion Air

When there is a loss of flame in the kiln burner or there is a loss of combustion air supply to the kiln burner, all waste feed to the kiln is shut off. These functions are performed by the flame supervisor serving the kiln and the AWFSO circuit. The flame supervisor receives a signal from the flame detector when there is a loss of flame in the burner. The supervisor also receives a signal from the combustion air blower motor when the motor is not running. The flame supervisor closes the two redundant shutoff valves on the natural gas feed line and directs the AWFSO circuit to shut off the waste feed to the kiln.

5. Loss of Secondary Combustor Flame, Loss of SCC Air

When there is a loss of flame in the SCC burner or a loss of combustion air supply to the burner, all clean fuel to the secondary is shut off, feed to the kiln burner will remain on natural gas, and all waste to the kiln shutoff. These functions are performed by the flame supervisor serving the SCC burner and the AWFSO circuit. The flame supervisor receives a signal from the SCC flame detector when there is a loss of flame in the burner. The flame supervisor also receives a signal from the combustion air blower motor when it is not operating. The flame supervisor closes the two redundant shutoff valves on the natural gas feed line and directs the AWFSO circuit to shut off the waste feed to the kiln.

6. Low Water in the Waste Heat Boiler and Steam Drum

When the water level in the steam drum falls 4 inches below normal operating level, all waste feed to the kiln is shut off and an alarm sounded on the control panel. The AWFSO circuit is activated by the low level switch on the steam drum.

If the water level in the steam drum continues to fall and falls 7 inches below normal operating level, all natural gas feeds to the kiln and SCC are shut off and an alarm sounded on the control panel. These functions are activated by the low-low level switch on the steam drum which signals the flame supervisors serving the kiln and secondary combustor and the AWFSO circuit. The kiln flame supervisor closes the redundant shutoff valves on the natural gas feed line to the kiln burner. The SCC flame supervisor closes the redundant shutoff valves on the natural gas feed line to the SCC burner.

7. Low Kiln Outlet Gas Temperature

When the kiln outlet gas temperature falls below a selected value (1350 F for the NCBC project), waste feed to the kiln is shut off, and the natural gas feed to the SCC is continued. The AWFSO circuit is activated by one of the thermocouples in the outlet duct of the kiln.

8. Low Kiln Draft

When there is more than a five second loss of draft in the kiln the waste feed to the kiln is switched off, and the natural gas feed to the SCC is continued. The AWFSO circuit is activated by a high pressure switch on the outlet duct of the kiln.

9. High-High Packed Tower Inlet Temperature

The high-high packed tower inlet temperature (approximately 210 F) shuts all fuels to the kiln burner and the secondary burner which inactivates the AWFSO circuit.

10. Divert the Thermal Relief Valve

The actuation (opening) of the TRV between the SCC and the waste heat boiler activates the AWFSO circuit and all waste feed to the kiln is shut off.

11. Low Flow Rate to Scrubber Unit

Should the recirculation flow to the packed tower drops below 75 gpm or if the injector scrubber recirculation flow drops below 30 gpm, the AWFSO circuit is activated and all waste feed to the kiln is shut off.

12. Waste Feed/Auger Rotational Speed Control

Should the auger rotational speed exceed the predetermined setting, the AWFSO circuit is activated and all waste feed to the kiln is shut off. The auger speed setpoint is calculated from the (1) bulk density of the waste feed, (2) the percent moisture in the waste feed, and (3) the amount of material contained within the feed auger flights. This interlock was installed and functional prior to routine operations. In order to test the upper operating bounds during the verification test burns, this interlock was deactivated.

13. Gas Residence Time in SCC

Because gas residence time in the SCC was not calculated during the verification test burns, this interlock was deactivated; however, when active the gas residence time in the SCC can be calculated by the data acquisition and control computer using the following:

$$\text{Residence time} = \frac{\text{Secondary combustor volume}}{[\text{Total input mass flow} \times (\text{gas density})]}$$

where:

$$\text{Combustion gas density (pounds per cubic foot)} = \frac{39.7}{\text{Sec. combustor outlet gas temp} + 460^{\circ}\text{F}}$$

Should the calculated residence time fall below a setpoint time, the AWFSO circuit would be activated and all waste feed to the kiln is shut off.

I. SURVEILLANCE

During the operation of the MWP-2000 incinerator system, the on-shift technicians monitor, through the indicator devices in the control room trailer, the operating conditions of all parts of the system. This monitoring constitutes a continuous surveillance of the operation of the system. Through this monitoring, the technician is able to detect virtually any system malfunctions.

The waste and fuel feed surveillance requirements for the rotary kiln and the SCC are listed in Table F-1. This includes parameter, method, frequency of observation, location of monitor, and contingency procedures for apparent malfunction.

The thermal combustion process surveillance requirements for the rotary kiln and SCC are listed in Table F-2. Surveillance requirements for other parameters of the MWP-2000 incinerator system are listed in Table F-3. The type of information shown is similar to that for Table F-1.

MWP-2000 incinerator system components also undergo periodic inspection and maintenance. These requirements are listed in Table F-4.

Table F-1. Monitoring of waste and fuel feed rates

Parameter	Method	Frequency	Location[a]	Contingency[b]
Rotary Kiln				
Clean fuel feed	Orifice plate flow meter	Continually[c]	1	Repair as soon as possible
Solid waste feed	Calculated from weigh hopper or scale weights and time of feed	Averaged over each shift	4	Stop solid waste feed until weigh hopper or scale is repaired[d]
Secondary Combustion Chamber				
Clean fuel feed	Orifice plate flow meter	Continually[c]	6	Repair as soon as possible[d]

a. See Figure F-4 for location on process schematic diagram.

b. If the meter or measuring device can be repaired within 15 minutes, waste feed will not be discontinued.

c. The term continually means the process variable is indicated on the control panel readout on a continual basis.

d. During any malfunction, waste feed will be discontinued until the appropriate repairs are completed.

Table F-2. Monitoring of thermal combustion parameters

Parameter	Method	Frequency[a]	Location[b]	Contingency[c]
Stack gas oxygen concentration	ECEM[d]	Continually	8	Stop all waste feeds until monitor or sampling system is repaired[e]
Stack gas carbon monoxide concentration	ECEM[d]	Continually	8	Same as above
Stack gas carbon dioxide concentration	ECEM[d]	Continually	8	Same as above
Combustion efficiency	Calculated by data acquisition and control computer	Continually	8	--[e]
Secondary combustor outlet gas temperature	Thermocouple	Continually	9	--[e]
Secondary combustor gas residence time[f]	Calculated by data acquisition and control computer	Continually	1,10, 6,14, 9	--[e]

a. The term continually means the process variable is indicated on the control panel readout on a continual basis.

b. See Figure F-4 for location on process schematic diagram.

c. If the meter or measuring device can be repaired within 15 minutes, waste feed will not be discontinued.

d. Extractive continuous emission monitor.

e. During any malfunction, waste feed will be discontinued until the appropriate repairs are completed.

f. This parameter was not calculated during the verification test burns.

Table F-3. Monitoring of other operating parameters

Parameter	Method	Frequency[a]	Location[b]	Contingency[c]
Rotary Kiln				
Combustion air air feed rate	Annubar	Continually	10	--[d]
Burner flame	Flame detector	Continually	11	--[d]
Outlet gas temperature	Thermocouple	Continually	12	--[d]
Outlet pressure	Pressure transducer	Continually	13	--[d]
Secondary Combustion Chamber				
Combustion air feed rate	Annubar	Continually	14	--[d]
Burner flame	Flame detector	Continually	15	--[d]
Pressure drop across combustor	Differential pressure transducer	Continually	16	Repair as soon as possible
Waste Heat Boiler				
Outlet gas temperature	Thermocouple	Continually	18	Repair as soon as possible
Pressure drop across boiler	Differential pressure transducer	Continually	19	Repair as soon as possible
Steam pressure	Pressure indicator	Continually	20	Repair as soon as possible
Steam drum water level	Water level switches	Continually	22	--[d]
Makeup water flow rate	Orifice plate flow meter	Continually	23	Repair as soon as possible

Table F-3. (continued)

Parameter	Method	Frequency[a]	Location[b]	Contingency[c]
Effluent Neutralization System				
Recirculation flow rate	Magnetic flow meter	Continually	24	Repair as soon as possible
Recirculation flow low pressure	Pressure switch	Continually	25	Repair as soon as possible
Quench elbow outlet gas temperature	Thermocouple	Continually	27	Replace with spare thermocouple
Packed Tower				
Recirculation flow rate	Magnetic flow meter	Continually	28	--[d]
Recirculation flow rate from effluent neutralization tank	Magnetic flow meter	Continually	29	Repair as soon as possible
Makeup water flow rate	Orifice plate flow meter	Continually	30	Repair as soon as possible
Sump water level	Water level switches	Continually	31	Repair as soon as possible
Outlet vacuum	Pressure transducer	Continually	40	Repair as soon as possible
Ejector Scrubber				
Inlet gas temperature	Thermocouple	Continually	40	Replace with spare thermocouple
Outlet gas temperature	Thermocouple	Continually	41	Same as above

Table F-3. (continued)

Parameter	Method	Frequency[a]	Location[b]	Contingency[c]
Ejector Scrubber (continued)				
Steam low pressure	Low pressure switch	Continually	32	Use redundant pressure meter until switch is repaired
Pressure across demister	Differential pressure transducer	Continually	33	Repair as soon as possible
Recirculation flow rate	Orifice plate flow meter	Continually	34	--[e]
Makeup water flow rate	Orifice plate flow meter	Continually	35	Repair as soon as possible
Sump water level	Water level switches	Continually	36	Use sight glass until switches are repaired
Caustic flow rate	Volumetric measure from containers	Continually	37	N/A
Sump pH	pH probe	Continually	38	Manually draw samples and analyze for pH

a. The term continually means the process variable is indicated on the control panel readout on a continual basis.

b. See Figure F-4 for location on process schematic diagram.

c. If the meter or measuring device can be repaired within 15 minutes, waste feed will not be discontinued.

d. During any malfunction waste feed will be discontinued until the appropriate repairs are completed.

e. Extractive continuous emission monitor.

Table F-4. Equipment/instrument list for inspection/maintenance

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Rotary Kiln		
Waste feed to burner, lb/min	1	Continual
Clean fuel feed, lb/min	1	Continual
Sludge feed, lb/min	1	Continual
Wastewater feed, lb/min	1	Continual
Combustion air feed, lb/min	1	Continual
Vacuum, in. water	1	Continual
Outlet gas temperature, °F	1	Continual
Liquid waste and fuel feed lines	2	Inspect for leaks. Repair if found.
Pump and strainer on operating waste fuel feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Pump on operating clean fuel feed line	2	Switch feed to alternate pump.
Pump and strainer on operating wastewater feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Combustion air and supplemental air blowers	2	Check for overheated bearings and vibrations. Repair if found.
Solid waste feed conveyor and ram or screw feed	2	Inspect for visual signs of malfunction. Repair if found.
Sight glass into kiln and TV camera lens	2	Clean.
Hydraulic drive for ram or screw feed	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.

Table F-4. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Hydraulic drive for kiln	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.
Hydraulic drive for treated soil removal chain	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.
Feed pumps on waste fuel, clean fuel, wastewater and sludge feed lines	3	Inspect oil level. Fill if necessary.
Strainer on operating clean fuel feed line	3	Remove and clean.
Combustion air and supplemental air blowers	3	Lubricate.
Flame detector	5	Clean flame detector lens.
Propane tank serving burner pilot	3	Check tank pressure. Fill if necessary.
Burner	3	Visually inspect externally for signs of leaks, wear, overheating or damage.
Ram or screw feed	3	Inspect nuts. Tighten if loose.
Combustion air and supplemental air blowers	4	Inspect suction filters and replace cartridges if necessary.
Roller bearings	4	Lubricate.
Solid waste feed conveyor	5	Lubricate roller bearings.
Refractory	5	Inspect for loose brick, spalling, cracking, or other damage. Repair if necessary.

Table F-4. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Burner	5	Remove and clean nozzle and inspect for wear or damage. Repair if necessary.
Cyclones	5	Inspect refractory for damage. Repair if found.
Treated soil removal system	5	Inspect chain drag for excessive wear. Replace if found.
Mass flow meters on fuel, wastewater and sludge feed lines	5	Calibrate.
Combustion air and supplemental air blowers	5	Inspect vanes for damage or excessive wear. Repair if found.
Secondary Combustion Chamber		
Waste feed to burner, lb/min	1	Continual
Clean fuel feed, lb/min	1	Continual
Wastewater feed, lb/min	1	Continual
Combustion air feed, lb/min	1	Continual
Pressure drop, in. water	1	Continual
Outlet gas temperature, F	1	Continual
Liquid waste and fuel feed lines	2	Inspect for leaks. Repair if found.
Pump and strainer on operating waste fuel feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Pump on operating clean fuel feed line	2	Switch feed to alternate pump.

Table F-4. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Pump and strainer on operating wastewater feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Combustion air blower	2	Check for overheated bearings and vibrations. Repair if found.
Burner	2	Rod center tube of nozzle.
Sight glass into combustor and TV lens	2	Clean.
Feed pumps on waste fuel, clean fuel and wastewater feed lines	3	Inspect oil level. Fill if necessary.
Strainer on operating clean fuel feed line	3	Remove and clean.
Flame Detector	5	Clean flame detector lens.
Combustion air blower	3	Lubricate.
Propane tank serving burner pilot	4	Check tank pressure. Fill if necessary.
Burner	4	Visually inspect externally for signs of leaks, wear, overheating, or damage.
Combustion air blower	4	Inspect suction filter and replace cartridge if necessary.
Combustor	5	Clean out accumulated solids.
Refractory	5	Inspect for loose brick, spalling, cracking, or other damage. Repair if found.
Burner	5	Remove and clean nozzle and inspect for wear or damage. Repair if found.

Table F-4. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Flame Detector	5	Clean flame detector lens.
Mass flow meters on waste fuel, clean fuel and wastewater feed lines	5	Calibrate.
Oxygen monitor	5	Check fuel cell. Replace if required.

a. Key for frequency column: 1 = continual computer monitoring; 2 = daily; 3 = weekly; 4 = monthly; 5 = full shutdown.

APPENDIX G

TEST PLAN FOR MWP-2000 VERIFICATION TEST BURNS AT NCBC

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have therefore, been published without editing.

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1. INTRODUCTION AND GOALS

Beginning in September, 1986, the Unites States Air Force in cooperation with EG&G Idaho and ENSCO Environmental Services will conduct a research and development demonstration project at a former Herbicide Orange storage site locate at the Naval Construction Battalion Center, Gulfport , MS. The goal of that project is to obtain reliability and maintainability data on the MWP-2000 mobile incinerator which is manufactured and operated by ENSCO Environmental Services. That incinerator is a 4 ton/hr rotary kiln incinerator which will be used to process cement stabilized soil that is contaminate with 2,3,7,8 TCDD.

The purpose of this test plan is to define the operating conditions for the MWP-2000 mobile waste incinerator during the pre-operational tests and the reliability/maintainability tests.

The goals of the pre-operational tests are:

- to determine if the MWP-2000 can reduce the concentrations of tetra, penta, and hexachloro dibenzo-p-dioxins and the tetra, penta, and hexachloro dibenzo furans to levels less than 1 ppb. Additionally, it is desirable to reduce the level of those chemicals listed in Appendix A of the RD&D Permit application to levels acceptable for "delisting" of the treated soil under the Resource Conservation and Recovery Act.

- to verify weather or not the incinerator is capable of processing the cement stabilized soil without producing additional listed or characteristic hazardous waste.

- to ensure that the operation of the incinerator does not cause any adverse effects to human health or the environment.

These tests are not designed to show 99.9999% destruction removal efficiency for TCDD; the MWP-2000 incinerator has previously been shown to achieve a minimum of 99.9999% removal efficiency on PCB contaminated liquids and solids during the permit test burns in El Dorado, AR which were completed in March 1986.

Following these pre-operational test burns, the Environmental Protection Agency, the United States Air Force, and EG&G Idaho will review the data to determine if the incinerator meets the delisting criteria outlined in the Research Development and Demonstration Permit Application. If the criteria are met, and if the incinerator is deemed capable of economically processing the cement stabilized soil, then permission will be granted to continue with the operational tests and the processed soil would be placed back onto the former HO storage site and reconnoitered.

The reliability/maintainability tests are designed to verify the reliability and maintainability of the MWP-2000 during an extended continuous operational period of up to 150 days.

2.0 INCINERATOR CONSTRUCTION AND PROCESS DESCRIPTION

A detailed process description and construction details can be found in chapter 2 of the Research Demonstration and Development Permit Application, which is included as an attachment to the operating permit. Also included in the permit application is a description of the maintenance schedules which will be followed to ensure proper incinerator operation.

3.0 TEST PROCEDURES

3.1 Definitions

Successful clean soil test:	The clean soil test burn will be considered successful if the incinerator processes clean soil for 72 continuous hours at an average feed rate of 3 ton/hr or greater.
Clean soil:	Cement stabilized soil obtained from the former HO storage site that has a TCDD concentration less than 1.0 ppb.
Standby mode:	An incinerator operating condition where all normal operating parameters are maintained except that no waste is fed to the incinerator; the kiln and SCC are fired on natural gas only.
Soil feed rate:	Mass of soil fed to the incinerator as defined by the weigh hopper load cell and elapsed time measurement.

3.2 Clean soil test burn.

3.2.1 Purpose of test

The purpose of the clean soil test burn is to demonstrate that the MWP-2000 is fully operational and that all subsystems are operating within their design limits. In order to successfully complete this test, approximately 240 tons of clean soil will be processed.

3.2.2 Specific Test Direction

Upon completion of system setup, the incinerator will be fired up using natural gas. The operators will then gradually raise the

system temperature to their normal operating limits of 1200 to 1800 ^{o}F for the kiln and 2150^{o}F for the Secondary Combustion Chamber. Clean soil that was excavated per the Soil Handling and Excavation Plan, will be placed into the feed hopper and fed into the kiln at an initial feed rate of 1 ton/hr minimum. That feed rate will continue for approximately 1 hour while the kiln operating parameters stabilize. Then the incinerator operator will gradually increase the feed rate to 3 ton/hr.

This test will continue for a minimum of 72 continuous hours of operation at an average feed rate of 3 ton/hr or greater. This test may take longer than 72 hours to perform in order to obtain a successful 72 hour window.

After running the incinerator at 3 ton/hr for at least 3 hrs, the feed rate will be increased to 4 tons/hr. If the incinerator continues to operate satisfactorily, the feed rate will again be increased to 5 ton/hr. The purpose of the increased feed rate is to ensure that the waste feed system and the off gas system can adequately handle high mass feed rates before similar feed rates are attempted with contaminated soil.

During the test, all normal operating parameters will be monitored. Those parameters are listed in Table 1 along with the required boundary conditions. All data listed in Table 1 shall be recorded by the computer print-outs every 15 minutes.

No stack gas samples are required for this clean soil test burn, however, ash samples from the incinerator shall be analyzed for 2,3,7,8 TCDD by the Ensco on-call laboratory per Reference 1. That analysis will provide the analytical laboratory personnel additional experience in analyzing the ash matrix.

3.3 First Contaminated Soil Test Burn

3.3.1 Purpose of Test

The purpose of this first contaminated soil test burn is to determine if the MWP-2000 is capable of producing soil with a TCDD concentration less than 1 ppb using highly contaminated feed stock and an average operating feed rate of 3 ton/hr.

3.3.2 Specific Test Direction

Upon completion of the clean soil test burn, the incinerator operators shall discontinue feeding clean soil to the kiln and the kiln feed operators shall remove all clean soil from the feed hopper. The operators shall place the incinerator on standby mode for 1 hour to allow residual clean soil to be processed. Once the feed hopper is cleaned, the soil feed operators shall fill the feed hopper with contaminated soil obtained from the site in accordance with the Soil Handling and Excavation Plan.

When the standby period is complete, the incinerator operators shall begin feeding the contaminated soil into the kiln at a rate of 3 ton/hr. All normal operating procedures shall be followed and all normal operating parameters shall be monitored. Both the design limits and the operating parameters to be monitored are given in Table 1. All data listed in Table 1 shall be recorded by the computer print-outs every 15 minutes.

Once the incinerator has reached steady state operations at a feed rate of 3 tons/hr for one hour minimum, the EG&G Program manager shall inform the sampling subcontractor to begin the ash sampling, the brine water sampling, and the stack gas sampling as described in Reference 1. The sampling subcontractor shall continue to collect samples for 1 hour in accordance with Reference 1. When all necessary samples have been obtained, the sampling subcontractor shall inform the EG&G program manager who will in turn direct the ENSCO incinerator operators to discontinue soil feed to the kiln and to return to standby mode.

The ash samples collected during the test burn will be split; one portion will be sent to the Ensco on call laboratory for quick turn around analysis for 2,3,7,8-TCDD. The other portion of the ash sample will be sent to (TBD- to be determined) along with the brine water and stack gas samples for detailed verification analysis which will include analysis for a variety of constituents in addition to 2,3,7,8-TCDD. Additional details on verification analysis can be found in Reference 1.

The standby mode will be maintained for approximately 24 hours until the results of the TCDD concentration from the processed soil samples have been received from the Ensco on call laboratory and presented to the EG&G Program Manager.

If the TCDD concentration in the processed soil is less than 1 ppb, the the EG&G Program Manager will direct the incinerator operators to proceed to the next test point. If the TCDD analysis of the processed soil is greater than 1 ppb, then the EG&G Program Manager shall consult with the USAF representatives and the ENSCO Project Manager to determine the proper course of action. The results of the ash analysis performed by the Ensco on call laboratory will be used only by EG&G Idaho and the USAF to determine if additional contaminated soil test burns are warranted. The Ensco on call laboratory ash analysis will not be used as part of the verification analysis. The verification analysis will be performed by TBD and will analyze for a variety of constituents in addition to 2,3.7,8-TCDD as described in Reference 1.

3.4 Second Contaminated Soil Test Burn

3.4.1 Purpose of Test

The purpose of the second contaminated soil test burn is to determine if the MWP-2000 is capable of producing soil with a TCDD concentration less than 1 ppb using highly contaminated feed stock and an operating feed rate of 4 ton/hr.

3.4.2 Specific Test Direction

Upon successful completion of the 24 hour hold period following the first contaminated soil test burn, the EG&G Program Manager will instruct the incinerator operators to gradually increase the kiln feed rate to an average of 4 ton/hr.

Once the incinerator has reached steady state operations at 4 tons/hr for 1 hour minimum, the EG&G Program manager shall inform the sampling subcontractor to begin the ash sampling, the brine water sampling, and the stack gas sampling as described in Reference 1. The sampling subcontractor shall continue to collect samples for 1 hours in accordance with Reference 1. When all necessary samples have been obtained, the sampling subcontractor shall inform the EG&G program manager who will in turn direct the ENSCO incinerator operators to discontinue soil feed to the kiln and to return to standby mode.

The ash samples collected during the test burn will be split; one portion will be sent to the Ensco on call laboratory for quick turn around analysis for 2,3,7,8-TCDD. The other portion of the ash sample will be sent to (TBD- to be determined) along with the brine water and stack gas samples for detailed verification analysis which will include analysis for a variety of constituents in addition to 2,3,7,8-TCDD. Additional details on verification analysis can be found in Reference 1.

The standby mode will be maintained for approximately 24 hours until the results of the quick look TCDD concentration data from the processed soil samples have been received from the Ensco on call laboratory and presented to the EG&G Program Manager. Additional soil, brine water, and stack gas samples will be sent to TBD for detailed verification analysis per Reference 1.

If the quick look data indicates that the TCDD concentration in the processed soil is less than 1 ppb, the the EG&G Program Manager will direct the incinerator operators to proceed to the next test point. If the TCDD analysis of the processed soil is greater than 1 ppb, then the EG&G Program Manager shall consult with the USAF representatives and the ENSCO Project Manager to determine the proper course of action.

3.5 Third Contaminated Soil Test Burn

3.5.1 Purpose of Test

The purpose of the third contaminated soil test burn is to determine if the MWP-2000 is capable of producing soil with a TCDD concentration less than 1 ppb using highly contaminated feed stock and an operating feed rate between 4.5 and 5 tons/hr.

3.5.2 Specific Test Direction

If the quick look ash analysis for the second contaminated soil test burn shows the TCDD concentration to be less than 1 ppb, then the EG&G Program Manager will instruct the incinerator operators to gradually increase the kiln feed rate to 4.5 to 5 tons/hr. The ENSCO Project Manager must approve testing the incinerator at any feed rate greater than 4 tons/hr.

Once the incinerator has reached steady state operations at the specified feed rate for at least one hour, the EG&G Program Manager shall inform the sampling subcontractor to begin the ash sampling, the brine water sampling, and the stack gas sampling as described in Reference 1 of this attachment. The sampling subcontractor shall continue to collect samples for 1 hour in accordance with Reference 1. When all necessary samples have been obtained, the sampling subcontractor shall inform the EG&G Program Manager who will in turn direct the ENSCO incinerator operators to discontinue soil feed to the kiln and to return to standby mode for 2 hours minimum to allow all residual clean soil to be processed.

3.6 Reliability and Maintainability Test Procedures

After successful completion of the pre-operational test burns described previously an evaluation will made of all the data obtained during those tests. That evaluation will be conducted by representatives from the US Air Force, EG&G Idaho, ENSCO, Inc., EPA Region IV. Pending concurrence of all reviewing parties, permission will be granted to proceed to the full scale reliability and maintainability tests which are expected to last from 90 to 120 days. The data will also be presented to EPA-HQ Waste Characterization Branch in preparation for delisting efforts.

3.6.1 Specific Test Procedures

Upon concurrence of all reviewing parties, the ENSCO Program Manager shall instruct the incinerator operators to begin heating the kiln to the operating conditions listed in Table 1 using only natural gas for combustion and following the established normal

operating procedures. Once the incinerator has reached its prescribed operating conditions, contaminated soil will be fed into the incinerator and gradually increased to its maximum operating limit. The maximum operating limit will be established during the review process of the data obtained from the pre-operational test burns.

During the routine operating period all data listed in Table 1 will be recorded every 15 minutes by the computer print-outs. Accurate records will be kept on all normal and abnormal maintenance activities in order to ascertain the reliability and maintainability of the incinerator system. The soil to be incinerated shall be excavated and transported to the incinerator as detailed in the Soil Handling and Excavation Plan.

TABLE 1
OPERATING CONDITIONS AND MONITORED PARAMETERS

The following conditions and parameters shall be monitored during the preoperational test burns. The specified conditions are only recommended set points unless the parameter is indicated by an asterisk (*). Such noted parameters are specified in the RD&D Permit and therefore compliance is mandatory.

Parameter	Normal Set Point
Soil Feed Rate	Variable 3 - 5 ton/hr.
Soil Residence Time	Variable 20 - 60 min
Kiln Combustion Air Flow Rate	120 lbm/min
Kiln Outlet Gas Temperature*	1600 - 1800°F
Kiln Pressure*	negative pressure
SCC Combustion Air Flow Rate	300 lbm/min
SCC Outlet Gas Temperature*	2150°F minimum
SCC Pressure	negative
Outlet Soil Temperature	1600 - 1800°F
Gas Residence Time in SCC*	1.0 - 2 seconds
Combustion Efficiency*	99.9%
Boiler Outlet Gas Temp	450°F
Boiler Steam Pressure	220 - 240 psig
Steam Drum Level	40 - 60%
Boiler Makeup Water Flow Rate	20 - 30 gpm

TABLE 1
OPERATING CONDITIONS AND MONITORED PARAMETERS

Parameter	Normal Set Point
Quencher Recirculation Water Flow Rate	100 gpm
Quencher Makeup Water Flow Rate	15 gpm
Quencher Outlet Gas Temperature	190°F
Packed Tower Recirculation Water Flow*	170 gpm
Packed Tower makeup water flow rate	15 gpm
Scrubber Recirculation Water Flow Rate*	40 gpm
Scrubber Nozzle Steam Pressure	150 psig
Stack Gas Oxygen*	3% min.
Stack Gas CO*	50 ppm
Stack Gas CO_2	function of combustion efficiency
HCl emissions	1.8 kg/hr or 1% of HCl concentration into the scrubber, whichever is greater.
Particulate matter	180 mg/dscm corrected for O_2
Scrubber effluent water:	
2,3,7,8-TCDD	Non Detectable
2,4,5-T	Non Detectable
2,4-D	Non Detectable
pH	5.5 to 9.5

REFERENCES

1. D.B. Derrington, Jr. Sampling Plan Verification Burn Sampling of Ensco's MWP-2000 Incinerator During the treatment of Soil Containing 2,3,7,8-TCDD at NCBC Gulfport, MS Versar, Inc. Springfield, VA 22151 October 24, 1986.

APPENDIX H

ENSCO HEALTH AND SAFETY PLAN FOR MWP-2000 DEMONSTRATION AT NCBC

The documents contained in this appendix is the detailed health and safety plan used during the full-scale demonstration at NCBC. This documents was reproduced from the best available copy. Due to poor original legibility, the legibility of the microfiche editions is also poor. Persons requiring the information contained in this appendix may write to the technical libraries listed below to obtain photocopied versions of the appendix. A nominal charge will be levied to cover reproduction and archival costs. Please be prepared to provide the following information:

Report Title: Full-Scale Incineration System Demonstration Verification Test Burns at the Naval Construction Battalion Center, Gulfport, Mississippi: Treatability Tests

Report Number: ELS-TR-88-61, Volume: II, Part: 2, Appendix: H

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The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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ensco environmental services
a division of environmental systems company

July 25, 1986

E.G.& G. Idaho, Inc.
1580 Sawtell STreet
Idaho Falls, Idaho 83402

Attention: Mr. Daniel Haley

Subject: Health and Safety Program, EG&G/USAF Environmental Restoration

Dear Mr. Haley:

Enclosed please find two (2) copies of the subject program which contains revisions necessitated by your comments and the comments of Robin Billeau which you verbalized.

Sincerely,

ENSCO ENVIRONMENTAL SERVICES, INC.

Charles J. Myers
Certified Industrial Hygienist
Manager, Environmental Health and Safety
Site Remediation Services
Northeast/Midwest

CJM:jme

cc: F. Schwartz (memo only)
R. Billeau - EG&G
H. Williams - EG&G
G. Elliott - El Dorado

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HEALTH & SAFETY PROGRAM
E.G. & G./USAF ENVIRONMENTAL RESTORATION
GULFPORT, MISSISSIPPI

1.0 INTRODUCTION

ENSCO, Inc. is aware of the health and safety hazard potential of 2,3,7,8 tetrachloridibenzodioxin and other compounds which may be encountered during proposed project work. Potential exposure to employees through inhalation, skin absorption, and/or ingestion are concerns which will be addressed and minimized through the implementation and maintenance of this program throughout the project.

All ENSCO and subcontractor personnel will be thoroughly educated and trained as to the hazards of these materials, requirements for personal protective equipment, personal hygiene, personnel monitoring, and the health surveillance program.

It is only through the proper implementation and maintenance of such programs that maximum employee health and safety protection can be assured. This is a corporate policy which governs all aspects of ENSCO operations.

2.0 RESPONSIBILITIES

It will be the responsibility of all ENSCO employees to insure that all procedures implemented in accordance with this program are followed by all employees associated with this project. Key individuals with identified responsibilities will include:

Project Manager: has complete responsibility for all aspects of each assigned project. This includes health and safety program implementation and maintenance, cost control, project performance, customer relations, etc.

Health and Safety Officer: Has complete responsibility for the implementation and maintenance of all procedures in accordance with overall program design. Will have a minimum of three years work experience in the hazardous waste industry and will have a working understanding of all state and federal occupational health and safety requirements. Will report jointly to the ENSCO Project Manager and the Manager, Environmental Health and Safety. A resume will be submitted for approval prior to project startup. The individual will be trained in CPR and Red Cross First Aid.

Manager, Environmental Health and Safety, Charles J. Myers, Certified Industrial Hygienist, resume attached. Will be responsible for design and all program coordination.

Occupational Physician: Mitchell Ralph Zavon, M.D., (curriculum vitae attached), will be responsible for the design and maintenance of the health surveillance program for all employees associated with the project work.

3.0 HEALTH AND SAFETY EDUCATION AND TRAINING PROGRAM

All ENSCO operational employees participate in routine health and safety education and training programs. These programs, directed by the ENSCO Manager, Environmental Health and Safety, are designed to provide these employees with a thorough knowledge of hazardous materials, health and safety hazard potentials and compliance with federal OSHA and EPA requirements. As a minimum, this training includes the following:

A. Selection, use, and maintenance of respiratory protection equipment
B. Selection, use, and maintenance of personal protection equipment
C. Toxicology
D. Confined space entry
E. Health and safety considerations of hazardous materials
F. Personal hygiene
G. Factors influencing chemical reaction rates
H. Labeling and placarding

A training session, specific for the E.G. & G./USAF Environmental Restoration Project will be conducted for all operational employees involved with proposed project work prior to project initiation. Topics to be covered at this time include:

A. Acute and chronic effects of site-specific hazardous wastes. (MSDS discussion).
B. Required personal protective equipment and respirators.
C. Site entry and exit procedures.
D. Site specific emergency response and contingency plans.
E. Heat stress.

Copies of the "Leader's Guide", quizes, and classroom handouts, to be used in the pre-project training, are contained in Section 17. In addition, Manufacturer's Representatives will review, thoroughly, the correct operation and use of the Racal, Powered Air Purifying Respirators (PAPR). Employees will be fit tested in accordance with ANSI Z88.2-1980, "Qualitative Fit Testing", where required.

The ENSCO Health and Safety Officer will conduct weekly "tool box" health and safety meetings throughout proposed project work.

4.0 HEALTH SURVEILLANCE PROGRAM

All employees involved with this project work will participate in a health surveillance program under the direction of an Occupational Physician. This program will include a pre-project medical evaluation and a post-project follow-up examination. The pre-project evaluation will consist of the following:

- Comprehensive Health and Exposure History
- Physical Evaluation
- Urinalysis
- SMAC 24 including total cholesterol and High Density Lipoproteins and GGTP
- Complete blood count (CBC), differential, hematocrit, and hemoglobin.
- Alcohol and drug screen.
- Chest x-ray.
- Lumbar x-ray (2 views).
- Pulmonary Function Testing
- Audiometry
- Vision Testing (distant, near, color)

Additionally, each employee will be evaluated to determine if they are physically able to perform work while using respiratory protective equipment in compliance with 29 CFR Part 1910.134 and ANSI Z88.2 - 1980.

Prior to project start-up, medical services will be established locally in the event such services become necessary.

5.0 PERSONAL PROTECTION EQUIPMENT

The following personal protective equipment will be required for all employees entering the project work site:

- First layer
  - Employee under clothing
- Second layer
  - Cotton work coveralls
  - Cotton gloves
  - Socks and work boots
- Third layer
  - Tyvek disposable coveralls
  - Neoprene rubber gloves
  - Rubber boots

All disposable work clothing will be thermally destroyed during the course of the project.

In addition, respiratory protection requirements will consist, initially, of the following:

All employees involved with dirt handling operations, i.e. heavy equipment operators will require the use of NIOSH/MSHA approved full face, pressure-demand powered air purifying respirators equipped with organic vapor and high efficiency particulate arresting (HEPA) filtration cartridges.

All other employees involved with project work will require a NIOSH/MSHA approved full-face respirator equipped with organic vapor and high efficiency particulate arresting (HEPA) filtration cartridges.

Note: Cartridges will be changed at least weekly for the negative pressure respirators and when indicated by flow meter readings on the PAPR's.

6.0 SITE DELINEATION

The project site will be segregated into three distinct areas:

Contaminated Area (Red)
Contamination Reduction Area (Yellow)
Clear Area

Refer to Figures 6.1 and 6.2 for delineation during project set-up and processing, respectively.

All areas will be delineated and posted.

7.0 PERSONAL HYGIENE REQUIREMENTS

A Personal Hygiene Unit (PHU) will be located between the Clean Area and the Contamination Reduction Area. All personnel will be required to enter and exit the site through the PHU. This unit will contain segregated lockers for storage of street clothing and personal protective equipment. Shower and wash facilities will also be located in this unit. A typical trailer arrangement appears in Figure 7.1.

All employees will be required to wash hands, arms and face thoroughly for breaks and lunch. All employees will be required to shower thoroughly prior to site departure.

Figure 6.1

Site Delineation - Project Set-Up

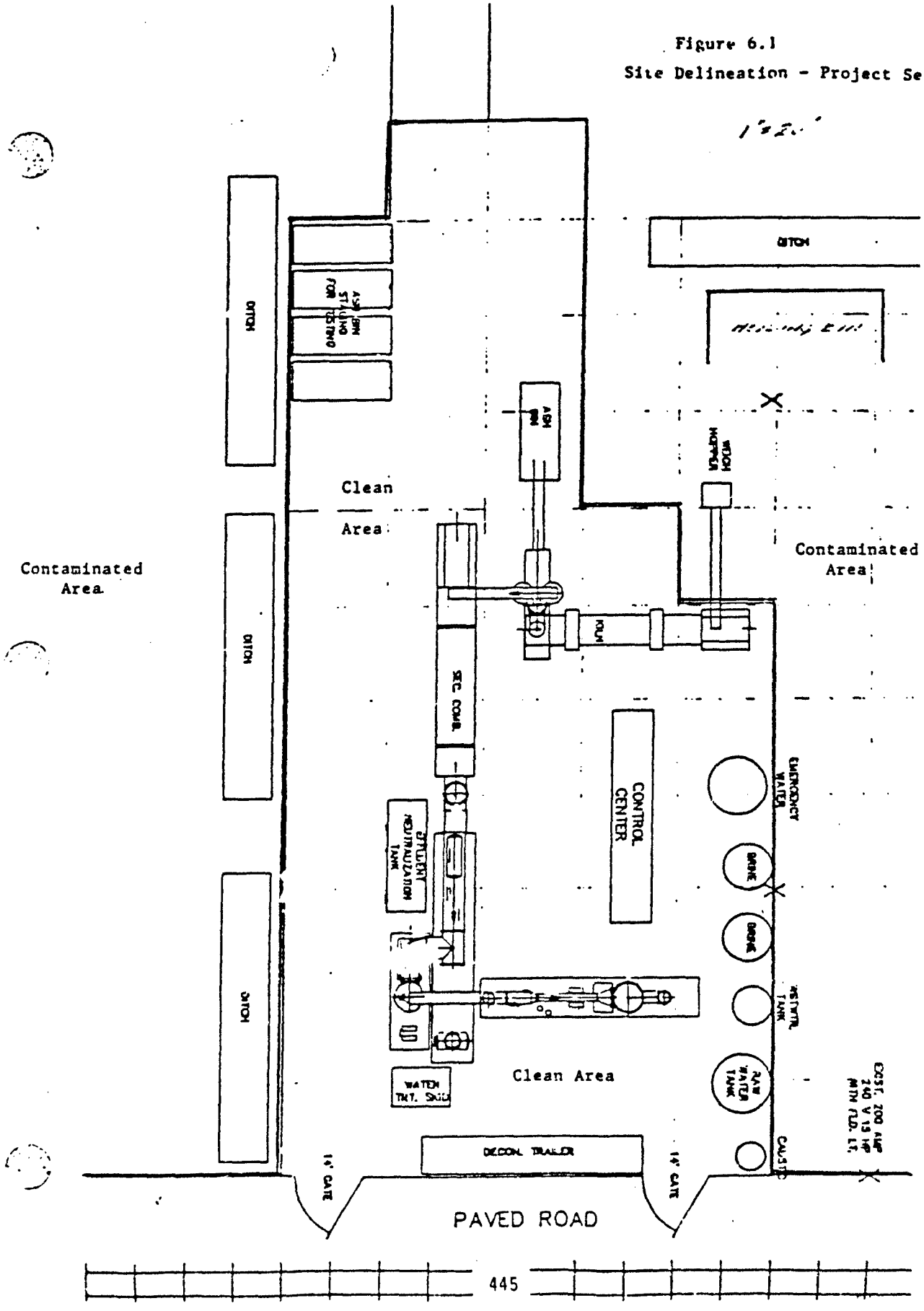
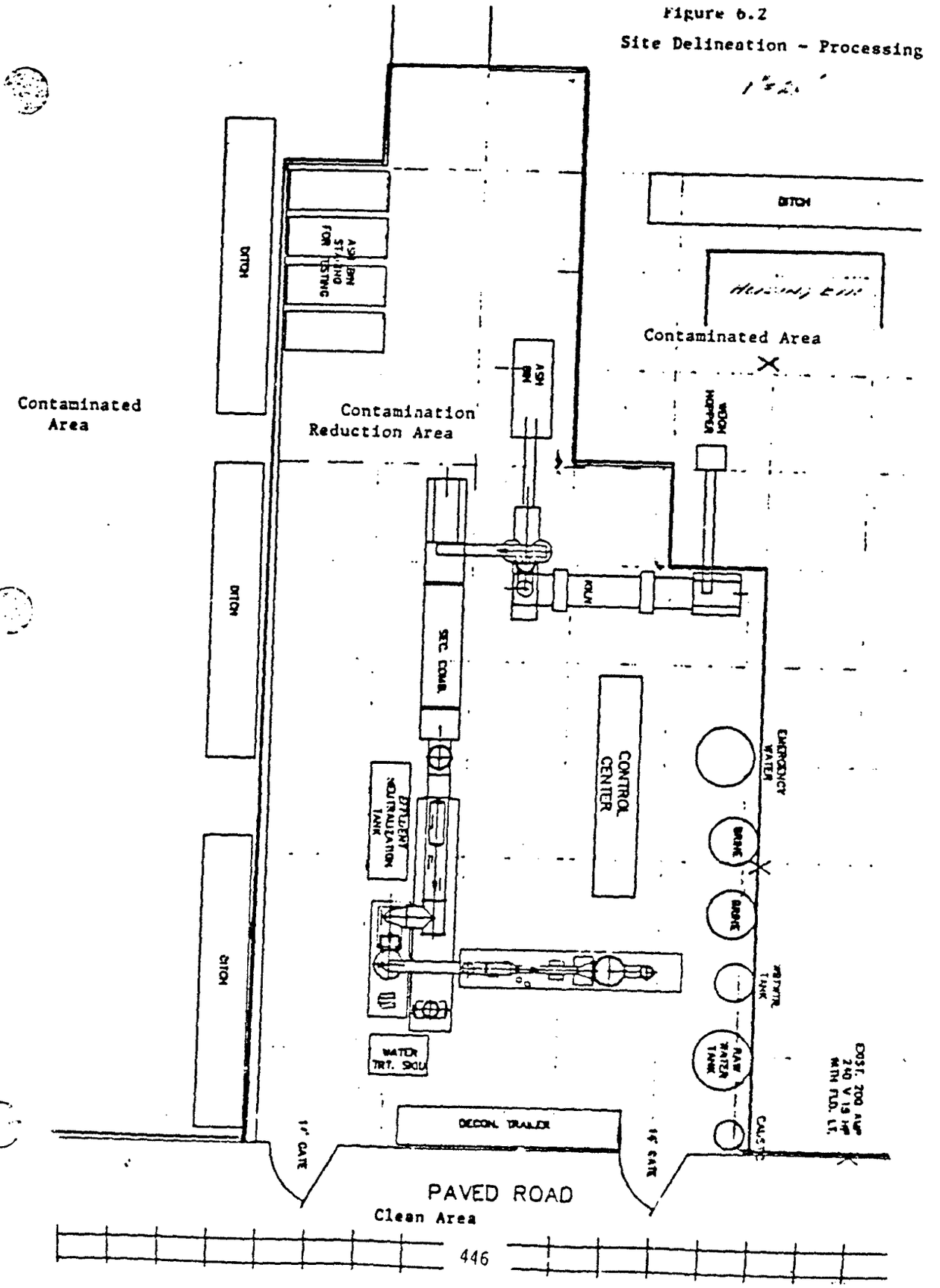


Figure 6.2

Site Delineation - Processing



All smoking materials will be stored in the lockers provided for street clothes storage. Smoking activities will be restricted to the clean area. Eating and drinking will be restricted to the designated clean area.

Decontamination procedures are to be strictly adhered to. These procedures are necessary to prevent contamination spread. Under no circumstances will personnel be permitted to leave the site with clothing suspected of being contaminated with materials associated with project work.

All contaminated clothing and personnel protective equipment are to be placed in the containers provided immediately outside the PHU.

Decontamination procedures will be posted at personnel and equipment decontamination areas and will be stressed as part of the site specific training requirements.

8.0 PERSONAL AIR MONITORING

Throughout the project, employee exposure assessments will be evaluated utilizing a glass fiber filter cassette and personal sampling pump. These assessments will be performed for those individuals identified as being involved with high exposure potential operations. Samples will be analyzed for 2,3,7,8 TCDD in accordance with recognized extraction and GC-ECD analytical procedures. (Method 613, "Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water" EPA-600/4 82-057 July, 1982.)

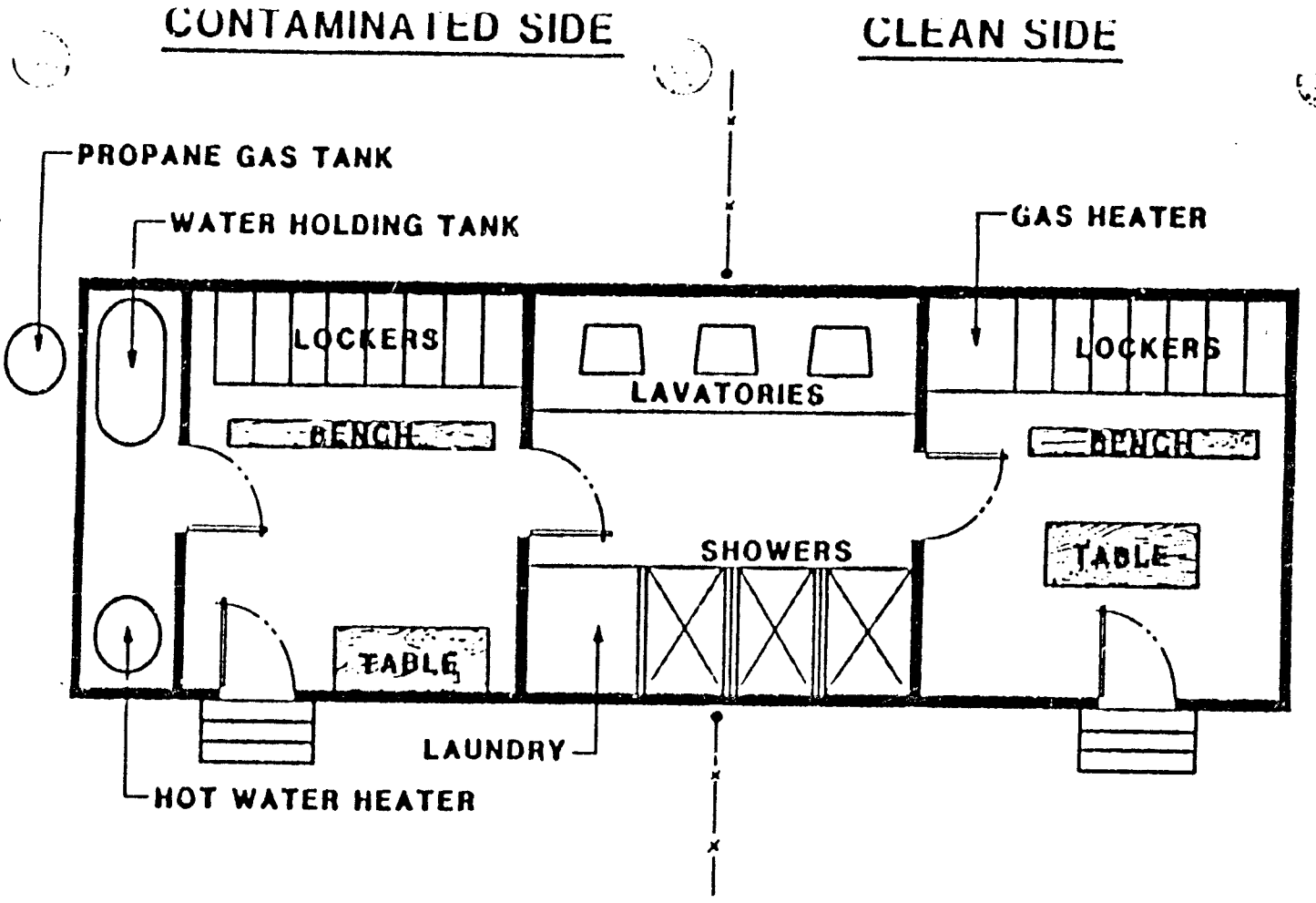
A portable dust monitor will be utilized to determine instantaneous dust concentrations periodically throughout dirt handling operations. Based on soil concentrations of 2,3,7,8 TCDD and realizing that 1% is equivalent to 10,000 ppm, calculations will be performed to estimate airborne concentrations during these operations.

A minimum of three personal samples per week and one portable dust monitor reading per day will be collected once processing begins.

9.0 CONTINGENCY PLANS

Personal Injury

1. Initial alarm and first aid. Upon observation of an injury, quickly get attention of other nearby workers. Immediately act to protect the injured person from a life-threatening situation. Render appropriate first aid. Warn unsuspecting persons of the potential hazard.



TYPICAL DECONTAMINATION TRAILER - PLAN VIEW

Figure 7.1

ensco environmental

2. Ambulance and hospital services. The ENSCO Project Supervisor or his representative will immediately assess the situation and, if necessary, notify the designated ambulance service and hospital of the emergency situation.

3. Notify ENSCO Project Supervisor and the E.G. & G. Project Manager. Utilizing available personal radio communications or other rapid method, notify the project managers or their representatives of the situation. Identify the injured person, the type of injury, and the project site location.

4. Follow-up. The ENSCO Project Supervisor will determine why the injury occurred and will take appropriate steps to prevent a similar recurrence. Events associated with the injury will be recorded in the ENSCO Supervisor's logbook.

Fire Contingency Plan

1. Initial alarm. Upon observation of any on-scene fire, immediately notify both project managers or their designated representatives. No attempt will be made to extinguish the fire prior to sounding the alarm.

2. Control and/or extinguish fire. Without risking personal injury, attempt to control or extinguish the fire utilizing available ABC-type fire extinguishers or clean burrow material. Do not use water except on wood or paper fires.

3. Notify local fire company. The ENSCO Project Supervisor will immediately assess the situation and notify the Fire Department of the location and type of fire. If necessary, either Project Manager may order the site evacuated until the fire is controlled or extinguished.

4. Follow-up. The ENSCO Project Supervisor will determine the cause of the fire and take appropriate steps to prevent a similar recurrence. Events associated with the fire will be recorded in the ENSCO Project Supervisor's logbook.

Spill Prevention and Contingency Plan

The ENSCO spill prevention plan includes the diking/berming of all fuel storage areas, the development of operating procedures with spill prevention designed in, and the training of employees in spill prevention and control techniques.

In the event of accidental spillage, the following flexible spill response will be implemented:

1. First aid will be administered to injured/contaminated persons. Any ENSCO employee observing spill will act immediately to remove and/or protect injured/contaminated persons from any life-threatening situation. First aid procedures will be implemented as appropriate.

2. Warn unsuspecting persons/vehicles of the hazard. ENSCO personnel will act to prevent any unsuspecting persons from coming in contact with spilled materials by alerting other nearby persons and by obtaining assistance of other ENSCO personnel who are familiar with spill control and cleanup techniques.

3. Stop the spill at the source, if possible. Without taking unnecessary risks, ENSCO personnel will attempt to stop the spill at the source. This may involve activities such as uprighting a drum, closing a valve, or temporarily sealing a hole with a plug. ENSCO personnel will not expend more than a brief effort prior to notifying the ENSCO Project Supervisor.

4. Notify the ENSCO Project Supervisor. Utilizing available personal radio communications or other rapid communication procedures, the Project Supervisor will be notified of the spill, including information on material spilled, quantity, personnel injuries, and immediate life-threatening hazards.

5. Spill assessment and primary containment. The ENSCO Project Supervisor will make a rapid assessment of the spill and direct primary containment measures. Depending upon the nature of the spill, primary containment measures may include, but are not limited to:

   - Construction of a temporary containment berm utilizing on-site clay absorbant earth, or other absorbant materials.
   - Placing drums under the leak to collect the spilling material before it flows over the ground.
   - Transferring the material from its original container to another container.

6. Notify the E.G. & G. Project Manager. The ENSCO Project Supervisor will notify the E.G. & G. Project Manager of the spill and steps taken to institute primary containment.

7. Spill cleanup procedures. The ENSCO Project Supervisor will develop a spill cleanup procedure taking into consideration associated hazards, quantity of spilled material, disposal methods and costs. The spill cleanup plan will be reviewed for acceptance by the E.G. & G. Project Manager.

8. Spill cleanup. ENSCO personnel will clean up all spills following the spill cleanup plan developed by the ENSCO Project Supervisor. The ENSCO Project Supervisor will supervise the spill cleanup. Most equipment, materials and supplies necessary to clean up a spill will already be immediately available on-site. Such items may include, but are not limited to: front-end loader, shovels, rakes, clay absorbant, polyethylene, personal safety equipment, steel drums, pumps and miscellaneous hand tools.

9. Spill cleanup inspection. The E.G. & G. Project Manager and ENSCO Supervisor will jointly inspect the spill site to determine that the spill has been cleaned up to the satisfaction of the E.G. & G. Project Manager.

Evacuation Contingency Plan

In the event that a decision is made by either the ENSCO Project Manager and/or the EG&G Project Manager or their representatives that an evacuation of the site is necessary, the following procedures will be initiated:

1. Simultaneously, via the two-way radios and by three successive blasts of air horns, evacuation signals will be initiated.

2. All employees will proceed to an up-wind position, as indicated by the wind sock, from the processing unit, via the shortest route. All protective clothing is to remain in the contaminated area.

3. All employees will be accounted for at this position.

4. Re-entry into the site will be restricted until instructed by the EG&G Project Manager.

Emergency Call Sheet

An emergency call sheet, as appears in Figure 9.1 will be completed and posted by all site-related telephones.

10.0 MISCELLANEOUS

The following outlines some additional items pertinent to the health and safety program:

- Dust control methodologies including water fogging will be utilized for all processes with dust generating potential.

- Two way intrinsically safe, radio communications will be utilized for all operations.

- Stretchers and first aid kits will be available and clearly visible at the Personal Hygiene Unit.

- Fire extinguishers will be located in all heavy equipment and transportation equipment.

- Local emergency response agencies, i.e. police, fire, and ambulance services, will be contacted prior to project startup to explain the operations, number of personnel, and expected response in the event of an emergency.

- Documentation of training records, medical records, and air monitoring records, will be provided to the E.G. & G. Project Manager.

11.0 HEAT STRESS

ENSCO, Inc. is completely familiar with problems associated with personnel wearing personal protective equipment in hot environments. This potentially serious condition is addressed through the following program elements; the health surveillance program, the employee education and training program, employee work practices, and environmental monitoring.

HEALTH SURVEILLANCE PROGRAM

This program, under the observation of a Certified Occupational Health Physician completely familiar with the metabolic and environmental contributions to potential factors which may contribute to potential factors which may contribute to heat related illnesses, is designated to screen and identify these individuals potentially susceptible to such illnesses. Based on information developed as part of the pre-project physical examinations, susceptible individuals will be prohibited from operations which may jeopardize individual employees.

EDUCATION AND TRAINING PROGRAM

As part of the pre-project education and training program, a separate section will present information regarding the signs and symptoms of heat related illnesses. Each employee will become familiar with those symptoms which may indicate the onset of the types of illnesses in both themselves and their fellow employees. These signs and symptoms will be continually reviewed with employees throughout the project duration.

EMPLOYEE WORK PRACTICES

As with any hazardous waste site project, employees will be prohibited from working in operational areas without being in direct visual observation of another employee. The use of this "buddy system" allows for continual observation of all employees for signs or symptoms of any chemical or physical exposure.

ENVIRONMENTAL MONITORING

At least three times per week, environmental monitoring for heat exposure will be performed in accordance with the wet bulb globe temperature (WBGT) methodology. These results will be recorded on the Field Sampling Data Sheet. This index will be utilized to establish appropriate work/rest regimens in accordance with recommendations outlined by the "American Conference of Governmental Industrial Hygienists' (ACGIH) in the "Threshold Limit Values" document. These values, corrected two degrees Centigrade for protective clothing, appear in Figure 11.1.

An air conditioned environment provided with replacement fluids will be available as a rest area for all operational employees.

12.0 LEVELS OF PROTECTION

GENERAL

Risk assessments performed by regulatory agencies on available information concering dioxin exposure and relative toxicity indicate that a level of 18 picograms per cubic meter be observed for non-protected employees.

PROTECTION FACTORS

Section 5.0 "Personal Protection Equipment" requires that all employees involved with dirt handling operations use a NIOSH/MSHA approved full face, pressure-demand powered air purifying respirator equipped with organic vapor and HEPA filtration cartridges. This equipment has a protection factor of 1000. Protection factors, as used by the National Institute for Occupational Safety and Health in developing guidelines, is defined as the ratio of contaminant concentration outside a respirator to the concentration inside the respirator. Its use allows for the calculation of a maximum use concentration in which a particular respirator will provide adequate protection to the wearer by multiplying the permissible exposure level by the protection factor. Using this calculation, the maximum use concentration for the respirators required is 18,000 picograms per cubic meter or 18 nanograms per cubic meter.

ACTION LEVELS

The use of full-face, pressure-demand, NIOSH/MSHA approved supplied air respirators equipped with 5-minute emergency egress bottles will be required in airborne concentrations of 2,3,7,8 TCDD in excess of 15 nanograms per cubic meter.

LEVELS OF PROTECTION

LEVEL OF PROTECTION	EQUIPMENT	PROTECTION PROVIDED	SUBSTANCES USED WHEN	LIMITING CRITERIA
A	RECOMMENDED • Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Fully-encapsulating chemical-resistant suit • Inner chemical-resistant gloves • Chemical-resistant safety boots/shoes • Two-way radio communications OPTIONAL • Cooling unit • Coveralls • Long cotton underwear • Hard hat • Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection	• The chemical substances have been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either measured (or potential for) high concentration of atmospheric vapors, gases or particulates or – site operations and work functions involving a high potential for splash, immersion or exposure to unexpected vapors, gases or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin • Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible • Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined	• Fully-encapsulating suit material must be compatible with the substances involved
B	RECOMMENDED • Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications OPTIONAL • Coveralls • Disposable boot covers • Face shield • Long cotton underwear	The same level of respiratory protection but less skin protection than Level A It is the minimum level recommended for initial site entries until the hazards have been further identified	• The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: – with IDLH concentrations of specific substances that do not represent a severe skin hazard, or – that do not meet the criteria for use of air-purifying respirators • Atmosphere contains less than 19.5 percent oxygen • Presence of incompletely identified vapors or gases is indicated by direct reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin	• Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin • Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates, or splashes of material that will affect exposed skin
C	RECOMMENDED • Full-facepiece, air-purifying canister-equipped respirator • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications OPTIONAL • Coveralls • Disposable boot covers • Face shield • Escape mask • Long cotton underwear	The same level of skin protection as Level B, but a lower level of respiratory protection	• The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin • The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant • All criteria for the use of air-purifying respirators are met	• Atmospheric concentration of chemicals must not exceed IDLH levels • The atmosphere must contain at least 19.5 percent oxygen
D	RECOMMENDED • Coveralls • Safety boots/shoes • Safety glasses or chemical splash goggles • Hard hat OPTIONAL • Gloves • Escape mask • Face shield	No respiratory protection. Minimal skin protection.	• The atmosphere contains no known hazard • Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals	• This level should not be worn in the Exclusion Zone • The atmosphere must contain at least 19.5 percent oxygen

LEVELS OF PROTECTION

Levels of protection, recommended equipment, protection provided, when to be used, and limiting criteria appear in Figure 12.1. This information will be utilized in determining appropriate levels of protection during this project.

Additionally, personal air monitoring, as discussed in Section 8.0 will be performed periodically.

13.0 DECONTAMINATION PROCEDURES

This section outlines Level B and Level C decontamination procedures.

LEVEL B DECONTAMINATION PROCEDURE

A. Equipment Worn

The full decontamination procedure outlined is for workers wearing Level B protection (with taped joints between gloves, boot, and suit) consisting of:

- One-piece, hooded, chemical-resistant splash suit.
- Self-contained breathing apparatus or air supplied respirator equipped with 5-minute emergency egress bottle.
- Hard hat.
- Chemical-resistant, steel toe and shank boots.
- Boot covers.
- Inner and outer gloves.

B. Procedure for Full Decontamination

Station 1: Segregated Equipment Drop

Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Boot Cover and Glove Wash

Scrub outer boot covers and gloves with decon solution or detergent/water.

Equipment: container (20-30 gallons)
detergent water
2-3 long-handle, soft-bristle scrub brushes

Station 3: Boot Cover and Glove Rinse

Rinse off decon solution from Station 2 using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
water
2-3 long-handle, soft-bristle scrub brushes

Station 4: Tape Removal

Remove tape around boots and gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 5: Boot Cover Removal

Remove boot covers and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool

Station 6: Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 7: Suit/Safety Boot Wash

Thoroughly wash chemical-resistant splash suit, respirator, gloves, and safety boots. Scrub with long-handle, soft-bristle scrub brush and copious amounts of detergent water. Wrap respirator regulator (if belt-mounted type) with plastic to keep out water. Wash backpack assembly with sponges or cloths.

Equipment: container (30-50 gallons)
detergent water

2-3 long-handle, soft-bristle scrub brushes
small buckets
sponges or cloths

Station 8: Suit/Respirator/Boot/Glove Rinse

Rinse off detergent water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
water
small buckets
2-3 long-handle, soft-bristle scrub brushes
sponges or cloths

Station 9: Tank Change

If worker leaves Exclusion Zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boots covers donned, and joints taped. Worker returns to duty.

Equipment: air tanks
tape
boot covers
gloves

Station 10: Safety Boot Removal

Remove safety boots and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Station 11: SCBA Backpack Removal

While still wearing facepiece, remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.

Equipment: table

Station 12: Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool

Station 13: Inner Glove Wash

Wash inner gloves with decon solution or detergent/water that will not harm skin. Repeat as many times as necessary.

Equipment: detergent water
basin or bucket
small table

Station 14: Inner Glove Rinse

Rinse inner gloves with water. Repeat as many times as necessary.

Equipment: water
basin or bucket
small table

Station 15: Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Station 16: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 17: Inner Clothing Removal

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing off-site since there is a possibility small amounts of contaminants might have been transferred in removing fully encapsulating suit.

Equipment: container (30-50 gallons)
plastic liners

Station 18: Personal Hygiene Unit

Shower if site exit is at end of shift. Wash hands and face if site exit is for breaks or lunch.

Equipment: water
soap
small tables
basins or buckets
field showers

Station 19: Redress

Put on clean clothes.

Equipment: tables
chairs
lockers
clothes

LEVEL C DECONTAMINATION PROCEDURE

A. Equipment Worn

The full decontamination procedure outlined is for workers wearing Level C protection (with taped joints between gloves, boots, and suit) consisting of:

- Tyvek disposable coveralls.
- Powered air purifying respirator.
- Hard hat.
- Chemical-resistant, steel toe and shank boots.
- Boot covers.
- Inner and outer gloves.

B. Procedure for Full Decontamination

Station 1: Segregated Equipment Drop

Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Boot Cover and Glove Wash

Scrub outer boot covers and gloves with detergent water.

Equipment: container (20-30 gallons)
detergent water
2-3 long-handle, soft-bristle scrub brushes

Station 3: Boot Cover and Glove Rinse

Rinse off decon solution from Station 2 using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
water
2-3 long-handle, soft bristle scrub brushes

Station 4: Tape Removal

Remove tape around boots and gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 5: Boot Cover Removal

Remove boot covers and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool

Station 6: Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 7: Suit/Safety Boot Wash

Thoroughly wash safety boots. Scrub with long-handle, soft-bristle scrub brush and copious amounts of detergent water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
detergent water
2-3 long-handle, soft-bristle scrub brushes

Station 8: Suit/Safety Boot Rinse

Rinse off detergent water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
water
2-3 long-handle, soft-bristle scrub brushes

Station 9: Canister or Mask Change

If worker leaves Contamination Area to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boots covers donned, and joints taped. Worker returns to duty.

Equipment: canister (or mask)
tape
boot covers
gloves

Station 10: Safety Boot Removal

Remove safety boots and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Station 11: Tyvek Disposable Coverall Removal

With assistance of helper, remove tyvek disposable coverall. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
bench or stool
liner

Station 12: Inner Glove Wash

Wash inner gloves with detergent water that will not harm skin. Repeat as many times as necessary.

Equipment: detergent water
basin or bucket

Station 13: Inner Glove Rinse

Rinse inner gloves with water. Repeat as many times as necessary.

Equipment: water
basin or bucket
small table

Station 14: Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit facepiece in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Station 15: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 16: Inner Clothing Removal

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing off-site since there is a possibility small amounts of contaminants might have been transferred in removing fully encapsulating suit.

Equipment: container (30-50 gallons)
plastic liners

Station 17: Personal Hygiene Unit

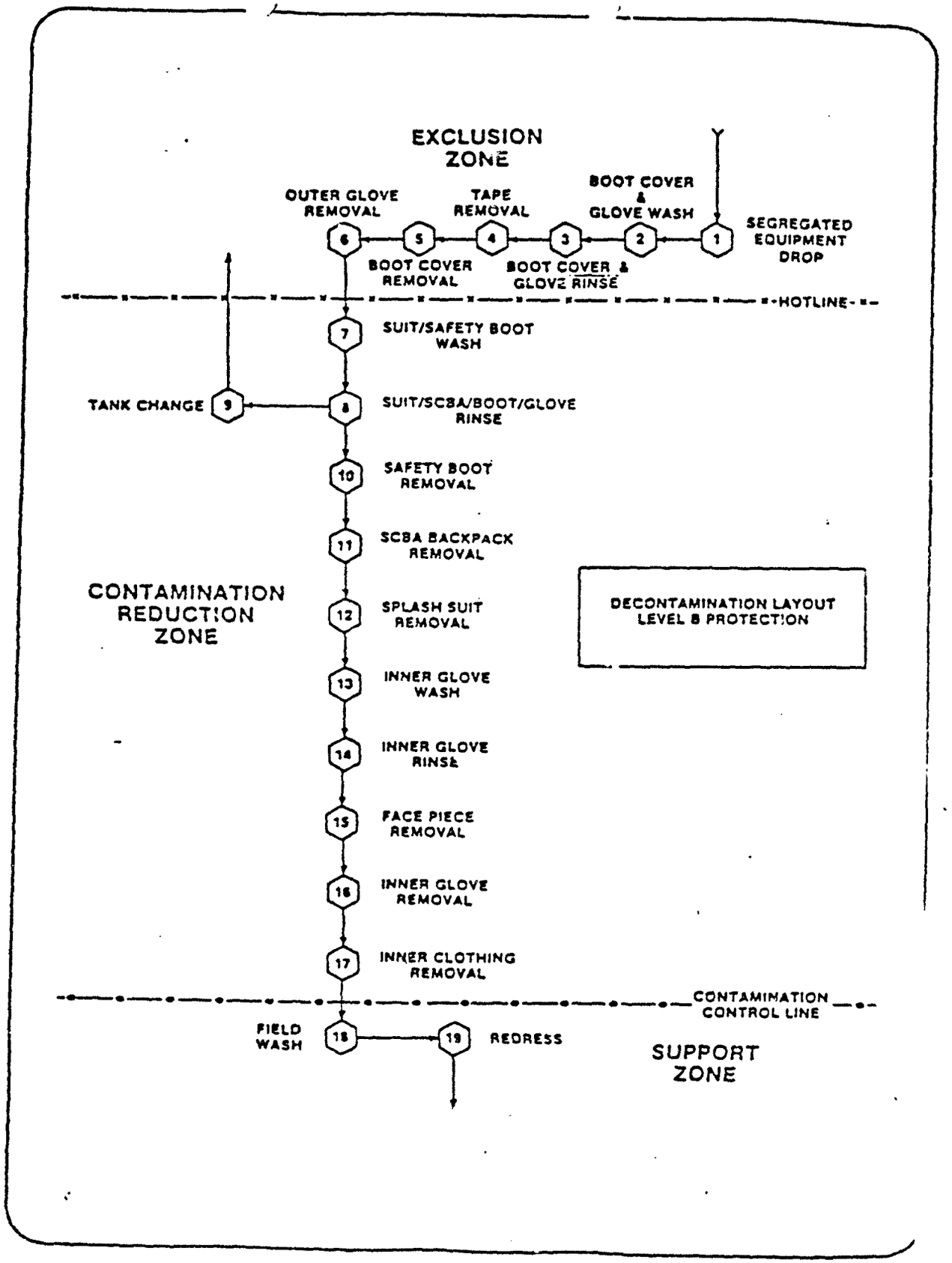
Shower if site exit is for end of shift. Wash hands and face if site exit is for breaks or lunch.

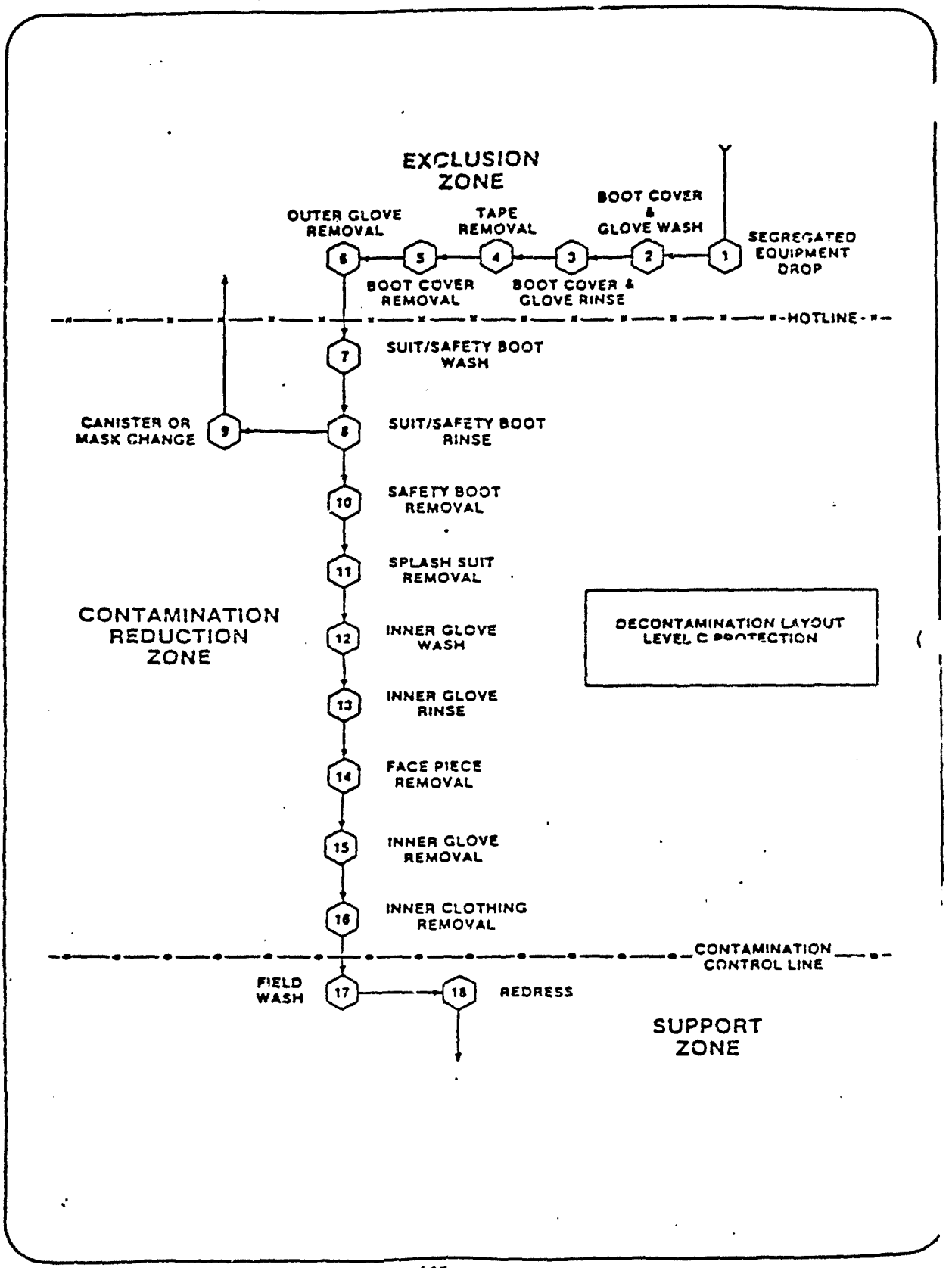
Equipment: water
soap
tables
wash basins/buckets
field showers

Station 18: Redress

Put on clean clothes.

Equipment: tables
chairs
lockers
clothes


EXCLUSION ZONE
OUTER GLOVE REMOVAL
TAPE REMOVAL
BOOT COVER & GLOVE WASH
SEGREGATED EQUIPMENT DROP
6
5
4
3
2
1
BOOT COVER REMOVAL
BOOT COVER & GLOVE RINSE
HOTLINE
7
SUIT/SAFETY BOOT WASH
TANK CHANGE
9
8
SUIT/SCBA/BOOT/GLOVE RINSE
10
SAFETY BOOT REMOVAL
11
SCBA BACKPACK REMOVAL
CONTAMINATION REDUCTION ZONE
12
SPLASH SUIT REMOVAL
DECONTAMINATION LAYOUT LEVEL B PROTECTION
13
INNER GLOVE WASH
14
INNER GLOVE RINSE
15
FACE PIECE REMOVAL
16
INNER GLOVE REMOVAL
17
INNER CLOTHING REMOVAL
CONTAMINATION CONTROL LINE
FIELD WASH
18
19
REDRESS
SUPPORT ZONE


EXCLUSION ZONE
OUTER GLOVE REMOVAL
TAPE REMOVAL
BOOT COVER & GLOVE WASH
SEGREGATED EQUIPMENT DROP
6
5
4
3
2
1
BOOT COVER REMOVAL
BOOT COVER & GLOVE RINSE
HOTLINE
7
SUIT/SAFETY BOOT WASH
CANISTER OR MASK CHANGE
9
8
SUIT/SAFETY BOOT RINSE
10
SAFETY BOOT REMOVAL
11
SPLASH SUIT REMOVAL
CONTAMINATION REDUCTION ZONE
12
INNER GLOVE WASH
DECONTAMINATION LAYOUT
LEVEL C PROTECTION
13
INNER GLOVE RINSE
14
FACE PIECE REMOVAL
15
INNER GLOVE REMOVAL
16
INNER CLOTHING REMOVAL
CONTAMINATION CONTROL LINE
FIELD WASH
17
18
REDRESS
SUPPORT ZONE

14.0 DOCUMENTATION

ensco environmental services
a division of environmental systems company

FIELD SAMPLING DATA SHEET

Date: _____ Project Number: _____

Weather Conditions: _____

_____

_____

Site Operations: _____

_____

_____

Type of Sampling Equipment: _____

_____

Time	Location	Results	Units	Comments

• ELDORADO, AR
• WHITE BLUFF, TENN
• BATON ROUGE, LOUISIANA

60 John Glenn Drive, Suite 104
Audubon Industrial Park, North Tonawanda, N.Y. 14120
(716) 691-7211

• LITTLE ROCK, AR
• N TONAWANDA, N Y

EMPLOYEE TRAINING RECORD

ensco environmental services
a division of environmental systems company

Project Number:_____ DATE:_____

Project Name:_____ SUPERVISOR/INSTRUCTOR_____

TOPICS DISCUSSED:_____

ATTENDENCE ROSTER

EMPLOYEE NAME (Print)	SOCIAL SECURITY NUMBER	EMPLOYEE SIGNATURE

• ELDORADO AR
• WHITE BLUFF, TENN
• BATON ROUGE LOUISIANA

60 John Glenn Drive, Suite 104
Audubon Industrial Park, North Tonawanda, N.Y. 14120
(716) 691-7211

• LITTLE ROCK AR
• N TONAWANDA N.Y.

AIR SAMPLING DATASHEET

ensco environmental services
a division of environmental systems company

Sampling Date:_____ Project Number:_____

1. Sampling Information

AMBIENT AIR	PERSONNEL EXPOSURE MONITORING
Monitoring Station:_____	Employee Name:_____
Pump Number:_____	Soc. Sec. Number:_____
Sample Number:_____	Pump Number:_____
Time On:_____	Sample Number:_____
Time Off:_____	Time On:_____
Time (Min.):_____	Time Off:_____
Comments:_____	Personal Protective Equipment:_____

2. Calibration

PRE-CALIBRATION	POST-CALIBRATION
Flow Rate (cc/min.)_____	Flow Rate (cc/min.)_____
Initials_____	Initials_____

3. Sample Results

Laboratory Results_____TWA

COMMENTS:_____

• ELDORADO, AR
• WHITE BLUFF, TENN
• BATON ROUGE LOUISIANA

60 John Glenn Drive, Suite 104
Audubon Industrial Park, North Tonawanda, N.Y. 14120
(716) 691-7211

• LITTLE ROCK AR
• N TONAWANDA N Y

JOB-SITE SAFETY INSPECTION CHECK LIST

		Yes	No
1.	OSHA and other job-site warnings posters		
2.	Safety Meeting		
3.	Adequate first-aid equipment and stretchers available?		
4.	Forms for job-site injury and accident records posted?		
5.	Are emergency telephone numbers conspicuously posted?		
6.	Zone II gate		
7.	Zone decontamination areas properly equipped		
8.	Zone decontamination procedures followed		
9.	General neatness of working areas/work trailer/shower trailers		
10.	Waste containers provided		
11.	Sanitary facilities adequate and clean		
12.	Adequate supply of drinking water		
13.	Disposable drinking cups		
14.	Trash receptacle for drinking cups		
15.	Wash station		
16.	Contaminated clothing in drums		
17.	Fire extinguishers identified, checked		
18.	"No Smoking" signs posted and enforced where needed		
19.	Storage, use and handling of flammable and combustible liquids in accordance with standards		
20.	All terminal boxes equipped with required covers		
21.	Have concealed electrical lines been located and marked?		
22.	Ladders inspected and in good condition		
23.	Onsite made ladders constructed of sound material?		
24.	Stepladders fully open when in use		
25.	Metal ladders not used around electrical hazards		
26.	Are ladders equipped with safety shoes?		
27.	Are ladders properly secured?		
28.	Guardrails and toeboards on all scaffolds and platforms more than 10' high or where needed		
29.	Access ladder provided for scaffolds		
30.	Equipment firmly supported		
31.	Outriggers		
32.	Signalman where needed		
33.	Proper fire protection		
34.	FLAMMABLE GASES/LIQUIDS-All containers clearly identified		
35.	FLAMMABLE GASES/LIQUIDS-Proper storage practices observed		
36.	FLAMMABLE GASES/LIQUIDS-Fire hazards checked		
37.	FLAMMABLE GASES/LIQUIDS-Proper types and numbers of extinguishers		
38.	WELDING-Flammable materials protected		
39.	WELDING-Gas lines protected and in good condition		
	PERSONAL PROTECTIVE EQUIPMENT:		
40.	Eye Protection is being used		
41.	Face shields		
42.	Respirators and masks		
43.	Helmets and hoods		
44.	Head protection		
45.	Gloves, aprons and sleeves		
46.	Ear Protection		
47.	Safety belts and lifelines provided		
48.	Suits		

JOB SITE SAFETY INSPECTION CHECK LIST

(CONTINUED)

		Yes	No
	PERSONAL PROTECTIVE EQUIPMENT (CONT'D):		
49.	Personal Protective Equipment used properly		
50.	Zone lines all up and in place		

PERSON(S) MAKING INSPECTION: _____

TITLE: _____ DATE: _____ TIME: _____

COMMENTS: _____

AUDIT INFO. # ITEMS YES _____

ITEMS NO _____

TOTAL 50

GRADE _____

APPENDIX I

EMERGENCY AND CONTINGENCY PLAN FOR FULL-SCALE DEMONSTRATION AT NCBC

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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4. EMERGENCY AND CONTINGENCY PLAN

4.1 Emergency Response

This section provides generalized guidance for contingency events associated with all activities at the NCBC and specifically provides for the demonstration of the ENSCO technology at the former HO storage site.

4.1.1 General Emergency Practices at NCBC

The emergency practices for NCBC personnel are outlined below.

1. Upon evacuation notice by NCBC, all personnel involved in this project must be prepared to evacuate the NCBC and do so when ordered.

2. NCBC requirements regarding hurricane protection will be observed. Specifically, equipment will have appropriate tiedowns in case of hurricanes.

4.1.2 Emergency Practices for NCBC HO Site

In addition to the preceding emergency practices, specific required practices related to HO site activities are presented below. Names and telephone numbers of emergency action coordinators involved with the demonstration and other responsible individuals will be provided to EPA at a later date for incorporation into a permit. The next two pages will be posted in work areas at the HO site prior to any onsite activity:

1. All personnel must be trained in the use of the personnel protective equipment specified in Section 5.

2. All personnel must be familiar with and implement procedures for health and environment for exposure or release to the environment of dioxin.

NCBC

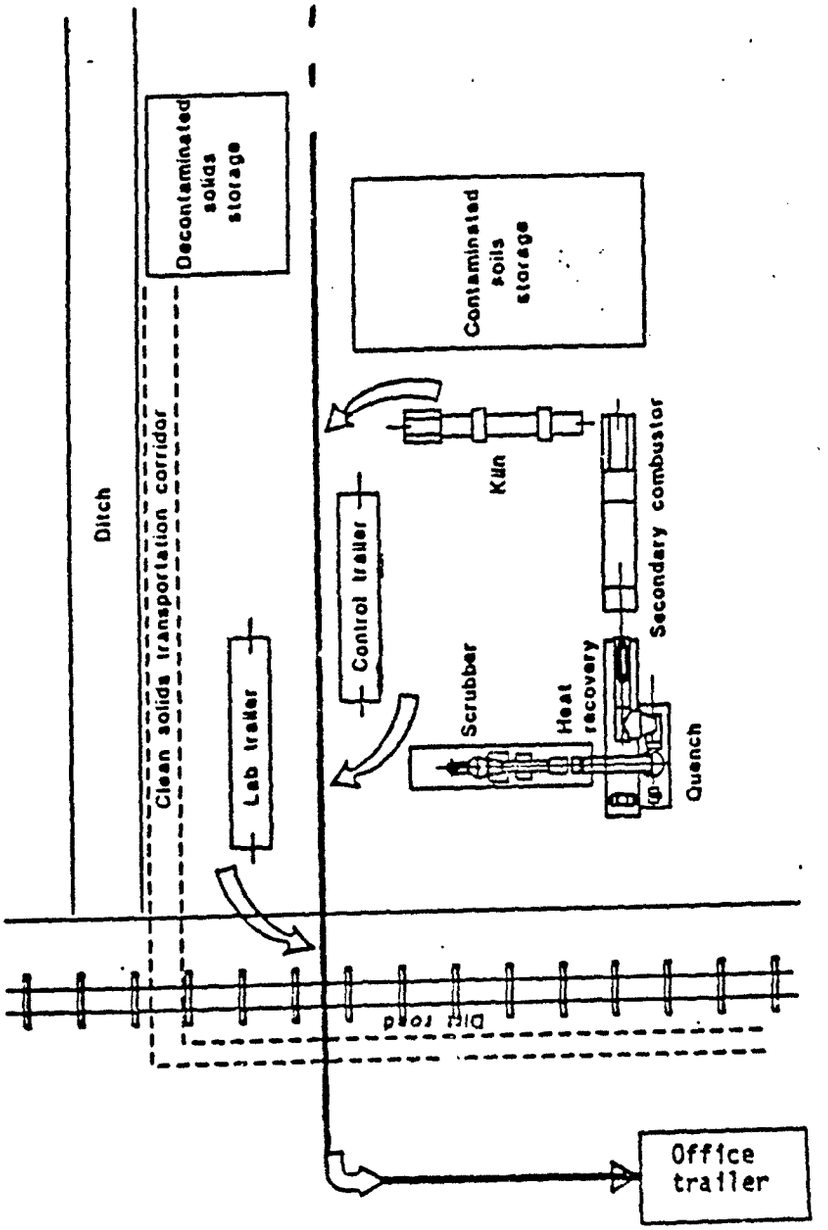
EMERGENCY RESPONSE

Fire Department	865-2333
Ambulance	865-2421
Hospital	863-1441
Security	865-2230
Safety Office	865-2437
Base Commander	865-2201

HO SITE

Project Manager	_____	_____
Alternate	_____	_____
ENSCO Supervisor	_____	_____

EVACUATION ROUTE



3. All personnel are to be trained in fire fighting for the materials involved in the demonstration activity. Minor or nonspreading fires will be extinguished according to procedures for the specific materials involved. Major or spreading fires will not be fought by demonstration personnel. All personnel will immediately evacuate the area and notify the NCBC fire department.

4. Any exposure to a hazardous material must be reported to the Project Manager and the NCBC first-aid station for evaluation and treatment.

5. All personnel will report releases of any hazardous material to the Project Manager.

6. All personnel will report abnormalities in equipment operation. Operation under unplanned or abnormal conditions will not be permitted.

7. Employee emergency guidelines in Section 5 will be followed.

8. Appropriate protective equipment and clothing must be worn when engaged in any emergency response/mitigation activity.

9. The Project Manager is responsible for reporting all incidents, abnormalities, and emergency responses to the appropriate agencies.

4.2 Hazard Assessment

The major mitigating factors to consider in assessing the potential impact of the incineration process on the surrounding areas and personnel are as follows:

a. Soil handling, where the total quantity of soil to be handled over the 90-day operating period is approximately 9000 yd^3. The vapor pressure of TCDD, 2,4,5-T, and 2,4-D is extremely low; and the primary means of migration from the immediate site is airborne particles. Therefore, all appropriate provisions will be taken to avoid fugitive dust emissions during soil handling (see Section 5 for ambient air monitoring and soil handling procedures).

4.3 Failure Modes

Postulated failure modes that could result from the demonstration activities on the HO site at NCBC are described below. Only the most likely failure modes or worst-case accident scenarios are presented.

4.3.1 Combustion Efficiency

When combustion efficiency drops below 99% and/or excess oxygen in the stack gases drops below 3%, the data acquisition and control computer will cut off all waste feeds to both units. The system will operate on fuel oil only until the operator can determine the cause of the malfunction and safely reinitiate the feeding of wastes.

4.3.2 Loss of Burner Flame

In the event of a loss of flame in the kiln, the kiln's ultraviolet flame detector will signal the data acquisition and control computer to cut off all fuel and waste feed to that unit; operation of the SSC will be maintained at normal operating conditions. The operator will relight the flame following normal operating procedures. When operating conditions are reestablished, the operator will reinitiate the feeding of soil to the kiln.

The the event of a loss of flame in the secondary combustion chamber, the flame supervisor serving that unit will signal the data acquisition and control computer to perform the following functions: cut off fuel feed to the SCC and cut off all waste feed to the kiln.

The operator will relight the flame and maintain the kiln at normal operating conditions. When normal operating conditions are reestablished in the SCC using diesel fuel, the operator will reinitiate waste feed to the kiln.

4.3.3 Steam Drum Water Loss

If the water level in the steam drum falls below the 25% level, the low-low-liquid level switch on the steam drum will alert the operator to shut off all waste and fuel feed to the kiln and the SCC. Upon hearing the alarm, the operator will perform the following steps:

- Cut off steam flow to the ejector scrubber
- Open the emergency vent on the SCC outlet duct
- Begin pumping makeup water into the steam drum
- Discontinue waste feed.

The operator then will ascertain the cause of the low water problem and will restart the system only after solving the problem.

4.3.4 Primary Power Failure

If a power outage occurs, operators will manually start the standby generator. The operator will then perform the following steps:

- Discontinue all waste and fuel feed to the kiln and SCC
- Restart the recirculation pumps in the air pollution control train
- Restart rotation of the kiln
- Restart the combustion air blowers
- Relight the burners in both the kiln and the SCC.

These steps will reestablish normal operating conditions in the kiln and SCC with the burning of diesel fuel only. If normal power is restored after the reestablishment of operating conditions, the operator will reinitiate waste feed to the kiln. If power is not restored within one hour after normal operating conditions have been reestablished, the operator will begin a normal shutdown of the system.

4.3.5 Loss of Coolant Makeup Water

If an interruption occurs in the makeup water supply system, an alarm will alert the operator to cease waste feed operations and initiate corrective actions.

A loss of makeup water would cause the steam drum to become depleted of water within 3.5 min. As a result, the quench system would fail, causing excessive temperatures in the packed tower and other equipment downstream. Such a series of events is unlikely.

If loss of quench water does occur, no health hazards would occur since the dioxin would be destroyed by the residual heat in the SCC and the kiln.

4.3.6 Computer Failure

Failure of the data acquisition system computer is an anticipated event. However, a computer "crash" should not cause any secondary process

accidents because the entire process is manually operated (with the exception of the flame supervisor).

The computer is an IBM personal computer. A spare computer is available in the control room, with a second computer available in the laboratory, if necessary.

Should a computer failure occur, the operator would discontinue waste feed and initiate repair operations. If the computer cannot be repaired or replaced within 60 min, the operator will begin routine shutdown operations.

4.3.7 Fires

Emergency plans for NCBC contain requirements for notification and evacuation in emergency situations involving fires. In addition, the base fire department will inspect the project site before operations to assess fire-fighting requirements specific to this project. The fire department is only three blocks from the project site. The type, number, and location of fire extinguishers at the project site are listed below.

(20) 20 lb dry chemical (powder)
Two extinguishers are mounted on each trailer and on the project grounds strategically located around the unit.

(2) 100-lb "wheel" units (nitrogen charged)
These units can be placed anywhere on the project as an extinguisher, near the tank farm or the secondary combustor, etc.

(1) 15-lb Haylon
Located in the control room.

(1) 12-lb Haylon
Located in the laboratory

(1) 15-lb CO_2
Located in the trailer

4.3.8 Maximum Hypothetical Accident (Explosion)

The maximum hypothetical accident would be an accident of unknown origin with the worst conceivable consequences. This scenarios would be an explosion in the incinerator system with subsequent internal dioxin contamination to the workers at the HO site. Those workers who are not wearing respirators, if uninjured from the postulated explosion, could quickly don their assigned respirators and evacuate the immediate area, thus minimizing their risk. The injuries sustained to a worker as a result of a postulated explosion are obviously much more significant than any potential injuries sustained as a result of dioxin contamination. Workers standing at the HO site boundary during such an accident could conceivably be exposed to dioxin during worst-case weather conditions. If an explosion were to occur, NCBC emergency response requirements would be immediately activated for notification and evacuation.

4.3.9 Effects on NCBC

An evaluation of the possible events presented in Sections 4.2 and 4.3 for impact to areas of NCBC other than the former HO storage site indicates that there will be no impact. Even the maximum hypothetical accident discussed in 4.3.7 will not impact any area outside the former HO storage site.

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APPENDIX J

SPILL PREVENTION CONTROL AND COUNTERMEASURES PLAN FOR FULL-SCALE DEMONSTRATION AT NCBC

The documents contained in this appendix were published according to their own internal style, which deviates from ESL format. They have, therefore, been published without editing.

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SPILL PREVENTION CONTROL AND COUNTERMEASURES PLAN FOR THE AIR FORCE INCINERATION PROJECT NCBC, GULFPORT, MS

NOVEMBER 3, 1986

Note: This document was ammended on November 20, 1986 to reflect changes in safety personnel and changes in the plan mandated by construction restraints. The changes are highlighted by a double asterisk (**) at the begining and end of the change.

1.0 INTRODUCTION

Beginning in September, 1986, the Unites States Air Force in cooperation with EG&G Idaho and ENSCO Environmental Services will conduct a research and development demonstration project at a former Herbicide Orange (HO) storage site located at the Naval Construction Battalion Center, Gulfport , MS. The goal of that project is to obtain reliability and maintainability data on the MWP-2000 mobile incinerator which is manufactured and operated by ENSCO Environmental Services. That incinerator is a 4 ton/hr rotary kiln incinerator which will be used to process cement stabilized soil that is contaminated with 2,3,7,8 TCDD.

The purpose of this document is to describe the methods and equipment which will be used to control potential spills which may contain hazardous substances.

Listed below is some general information pertaining to this Spill Prevention Control and Countermeasures (SPCC) plan.

Facility Name:	Former Herbicide Orange Storage Site NCBC Gulfport, MS
Type of Equipment:	Two stage rotary kiln incinerator for hazardous waste incineration
Permittees:	United States Air Force United States Navy
**SPCC Officer	Steve Saunders, Ensco Environmental Services**
Previous spillage of hazardous substances	None, however substantial quantities of herbicide orange was spilled during previous operations in the 1960s and 1970s. (This spillage is the impetus for the hazardous waste incineration research activities on this site.) This incineration activity has had no spillage of any hazardous substance.

2.0 SITE DESCRIPTION AND NATURAL SPILL CONTAINMENT

The MWP-2000 incinerator is located on the former Herbicide Orange storage site. That site is bounded on three sides by the railroad tracks and an 18 in high soil berm on the far eastern end of the site as illustrated in Figure 1. **This area is refered to as the SPCC control area.** Sediment filters have been constructed on all drainage ditches. These barriers would act as the final spill containment barriers in the event of a large volume spill within the former HO storage site.

Additional barriers and spill protection measures have been taken in the areas containing hazardous substances. The hazardous substances their spill potential and the spill protection techniques are described below.

3.0 HAZARDOUS SUBSTANCE INVENTORY AND SPILL POTENTIAL

3.1 Mercury (Hg)

Approximately one pint of mercury is stored in the instrument calibration trailer on the former HO storage site. It is used for instrument calibration. The spill potential is minimal because the mercury is contained in a sealed glass bottle inside of the control room trailer.

3.2 Quench Tank

The quench tank is located adjacent to the Secondary Combustion Chamber (SCC) of the incinerator. It receives cooling water from the quench elbow. The tank volume is approximately 5000 gallons.

Because the quench elbow receives process off gas from the SCC, the quench tank would only contain a hazardous substance, such as 2,3,7,8-TCDD, 2,4-D, or 2,4,5-T, if the incinerator process failed, i.e., if either the temperature or residence time of the SCC were below their prescribed limits which would cause incomplete combustion of the incinerator off gases.

A hazardous spill from the effluent tank would only occur if the incinerator process failed and if a leak developed in the effluent tank. It is unlikely that the tank would develop a leak because the effluent tank is fabricated out of 1/4 in. carbon steel with welded seams and bolted flanges. Furthermore, the tank is not exposed to a high temperature atmosphere. Therefore, the spill potential for this tank is considered very low.

If in the unlikely event of a spill from the quench tank, the contaminated solids would be contained within the SPCC control area. Furthermore, absorbant clay and sand are readily available on site to prevent spillage from spreading. The clay is located in the safety storage trailer and the sand is located in the clean spoils area. A front end loader is available to move the spill control materials to any spill on site.

3.3 Scrubber Effluent Tank

Two 12,000 gallon tanks are located outside of the incinerator area and within a diked area that is lined with three layers of 10 mill polyethylene plastic. The diked area is also stabilized with a layer of geotextile material. The purpose of those tanks is is to receive the effluent water from the air pollution control scrubber *after the water has been filtered through activated charcoal bed.* Similar to the quench tank, the effluent tanks could only contain trace quantities of TCDD, 2,4,D, or 2,4,5-T if the incinerator process failed.

The water contained within the effluent tanks will be collected and analyzed for 2,4-D or 2,4,5-T. If the analysis shows the water to be clean, then it will be discharged to the Publicly Owned Treatment Works (POTW) sewer. If the water is contaminated, then it will be processed in the incinerator. A POTW permit has been obtained from the Mississippi State Department of Natural Resources.

The tanks are fabricated out of 9/16 in. carbon steel with bolted flanges. The tanks are not in a high temperature or high pressure atmosphere. Therefore, the potential for a spill from those tanks is considered low.

In the unlikely event of a spill from the scrubber effluent tank, the liquid would be contained within the bermed area which is sized to contain approximately 13,500 gallons. Because only one tank will be used at any given time, 13,500 gallons is sufficient to contain the contents of one the effluent tank.

3.4 FUEL STORAGE AREA

Two fuel storage tanks are located outside of the former HO storage site. Those tanks are 250 gallons each; one tank contains diesel fuel and the other tank contains gasoline. The tanks are inside a bermed area than can contain 450 gallons. The bermed are is lined with an spcc-sorbant blanket

Due to the nature of fueling operations, a small spill is likely, however it would be contained within the bermed storage area. Furthermore, the spcc-sorbant blanket would absorb any spilled fuel. Rainwater will be drained from the bermed area as needed.

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3.5 ACIDS AND CAUSTICS

Potassium Hydroxide is used for boiler feedwater pH and oxygen control. Approximately 4 barrels each 55 gallons are stored in the incinerator area in a lined and bearmed area. The berm is made of un treated railroad ties, and the liner is made of two layers of 10 mill polyethylene plastic.

Acid is used for boiler water and quench water pH control. Approximately 2 drums, each 55 gallons are stored on site in a bermed area. The bearm is constructed the same as for the caustics. The acid storage area is located ??? feet away from the caustic storage area in accordance with the requirements of 40CFR 261.

In the event of a spill from either the acid or caustic storage area, the berm would collect the spill. Absorbant clay and sand would be placed over the spill. The clay and sand would then be either drummed and disposed in accordance with applicable regulations or incinerated on site.
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4.0 SPILL COUNTERMEASURES

Every hazardous waste spill is a unique event and therefore must be treated on a case by case basis. In general, however, the following steps will be taken. In the event of a hazardous liquid spill the following general steps will be taken to protect human health and the environment.

1. Upon discovery of a hazardous substance spill, evacuate all personnel from the immediate area and notify the Ensco Health and Safety Officer or his designated alternate. He can be contacted directly, on telephone extension 31, on the two-way radios.

2. The health and safety officer will determine the risks and appropriate cleanup action.

3. Any tipped containers which maybe involved in the incident should be uprighted.

4. If appropriate, drip pans will be place under any leaking or valves flanges. The collected material will be treated as hazardous waste.

5. The spill will be isolated in order to prevent contamination spread. To isolate a spill soil, straw or other absorbent material will be piled around the spill. Additional containment may be accomplished by using plastic as a liquid barrier.

6. The spilled material and absorbent material will be collected and disposed according to EPA requirements. Liquid material may be pumped into drums or other suitable containers. Solids may be shoveled into drums or the available earth moving equipment may be used to scrape up the material.

If the spilled material is consistent with the material that the project is permitted to process, then the spilled material will be processed in the incinerator. If the permit does not allow processing the particular spilled material, then that material will be drummed and sent to a hazardous waste disposal facility.

7. In all cases, every attempt will be made to prevent a spilled material from flowing into a storm drain or sewer. If in the unlikely event a spill does reach a storm drain or sewer, then the city of Gulfport Sewer department will be notified at 868-5765 or 863-0324.

8. The following government agencies will be notified of the spill, its extent, and the basic clean-up plan soon after all personnel are protected.

EPA Emergency Response Notification: (800) 424-9346
Mississippi Dept. of Natural Resources: (601) 961-5171

The following persons will also be notified in the event of a spill or any other on site emerency.

Ensco Emergency Response,	Gulfport,MS:	(601) 863-0220
	Little Rock AR	(501) 375-8444
	Louisiana	(504) 389-0988
NCBC Duty Officer		(601) 865-2255
NCBC Public Works Office		(601) 865-2484

5.0 HEALTH AND SAFETY PRECAUTIONS

In the event of spill the following health and safety precautions will be taken as a minimum.

1. All personnel will be evacuated from the immediate area to an area upwind of the spill.

2. If fumes or vapors are being emitted from the spilled material, protective breathing devices must be worn. Scott Air Packs are stored in the Health and Safety Supply trailer which is located outside of the HO site.

3. Reentry to a spill area will require appropriate protective clothing such as Tyvek suits, rubber boots and gloves, goggles and a hood.

4. If any individual have been splashed with toxic materials, flush the splashed area with large quantities of water from a safety shower or hose. If the victim's face or eyes are involved, an eye wash station should be used.

5. If the hazardous material gets on a person clothing, the clothing will be removed and the affected skin will be thoroughly washed. The clothing will be disposed as hazardous waste.

6. If personnel are injured, the ambulance will be called (865-2242) and the on call site doctor will be contacted (896-7311). That doctor has been informed on the particular hazards of this project.

If a major spill has occurred which results in contamination of the environment, a site specific remedial action plan will be developed.

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